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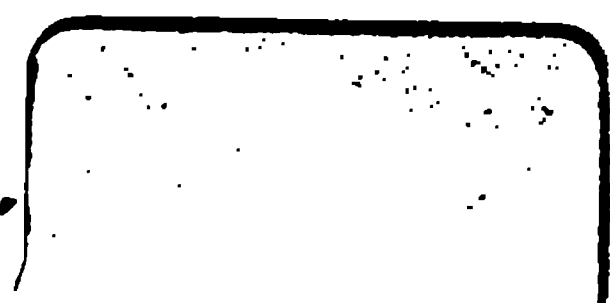
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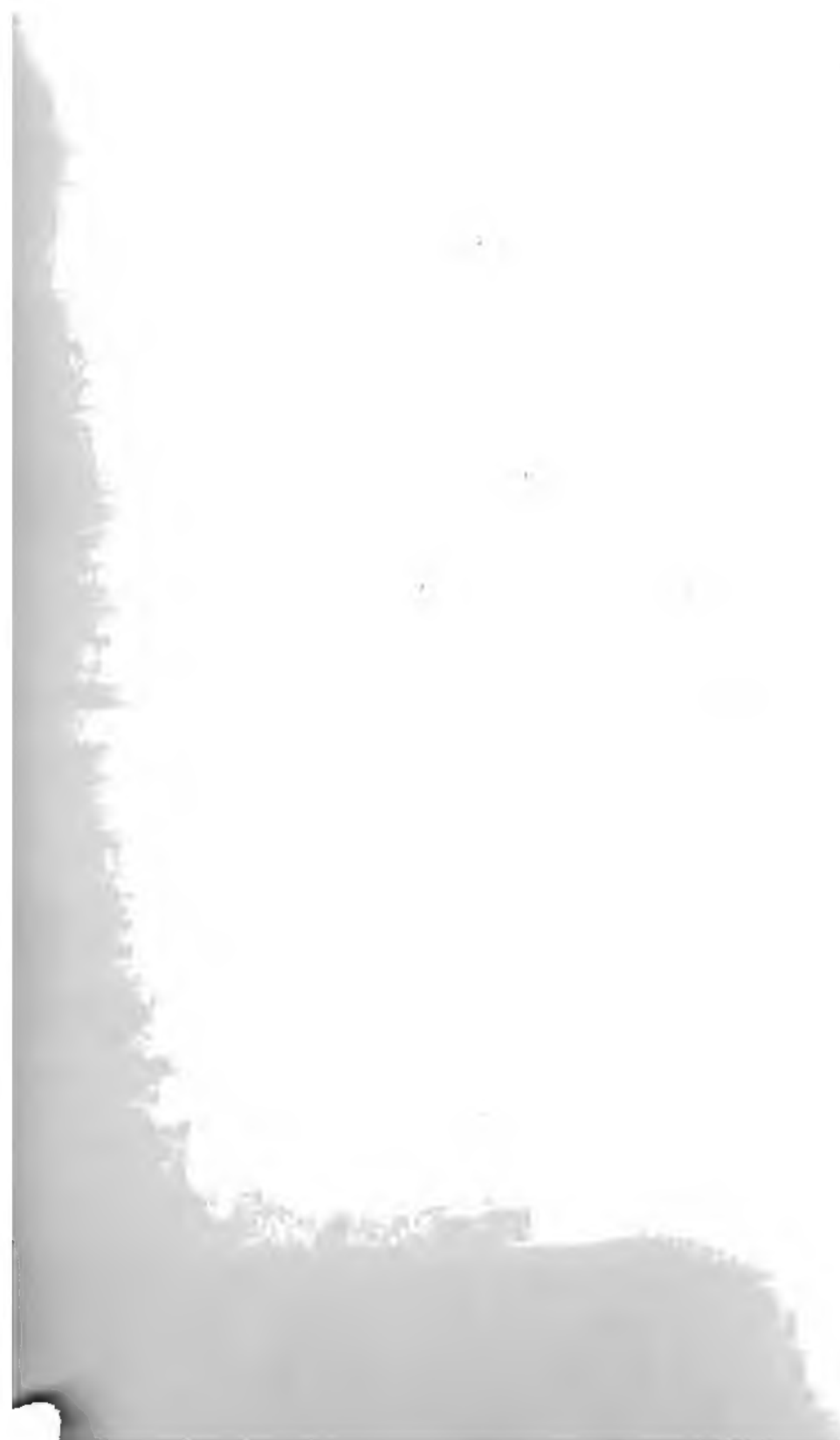
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VHCA
Kentucky
Mines



ANNUAL REPORTS

OF THEM



Inspector of Mines

OF THEM

STATE OF KENTUCKY,

For 1901 and 1902.

C. J. NORWOOD, Chief Inspector,
A. G. SPILLMAN, Assistant.

Prepared by the Chief Inspector.
OFFICE: LEXINGTON, KY.

LOUISVILLE, KY.
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ASTOR LENOX AND
TILDEN FOUNDATIONS

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LETTER OF TRANSMITTAL.

To His Excellency, J. C. W. BECKHAM,

Governor of Kentucky.

Sir: I have the honor to submit herewith the report of this office for the calendar year 1902.

Circumstances being unfavorable for my undertaking to prepare a report covering the last year of service of my predecessor, Hon. G. W. Stone, who retired from office January 19, 1902, no report for 1901 was issued. Had it been a question of preparing the statistical matter only, a report for that year could have been issued, but I was not in position to prepare the entire report. Statistics relating to that year were published in the daily press as soon as completed, and they are included in this report.

In consequence of an injury (a broken ankle) received in December, 1901, and the difficulty attending locomotion which followed an unsatisfactory repair of the fractured bones, I was unable to bear my proper part of the field work of the office during the past year. Practically all the mine inspections, therefore, were made by the Assistant Inspector, Mr. A. G. Spillman, and I take pleasure in commending him for the energy and faithfulness with which he has performed his work. He has been not only diligent, but efficient; and through frequent conferences with him concerning the details of his inspections, coupled with familiarity with the mines in the past, I have been kept in such touch with the underground conditions of the mines that I have been in position to supervise the field operations in an intelligent way.

I have the satisfaction of presenting a paper prepared for this report by Mr. Hywel Davies, Vice-President and Manager of the Main Jellico Mountain Coal Co., giving an account of the long-wall mining operations he has undertaken at one of his company's

mines. The paper is fully illustrated, and I believe it will be studied with both interest and profit by those who have to deal with the question Mr. Davies has taken up, namely, the mining of thin coal seams in the Jellico region. The question is an important one, and Mr. Davies has my thanks for his contribution on the subject.

In continuation of the course which has been followed by this office for many years, and in accordance with the sanction of the mining law, I have sought to make this report serviceable in promoting the development of the mineral resources of the State, as well as a record of the mining operations. I have, therefore, in obedience to the unceasing demands for such information, reprinted some matter contained in certain reports, the editions of which are now exhausted. Included with the reprinted matter, most of which originally appeared in reports of this office, is a report which was originally issued by the State Geological Survey on portions of the Eastern coal-field. For thirty years I have, in various relations, been closely associated with the development of the State. At no time during that period has the demand for authentic official information concerning our mineral resources been more insistent or of more consequence than it is now. I trust, therefore, that the reprinting of the matter indicated will receive your approval.

I have the honor to be,

Your obedient servant,

CHARLES J. NORWOOD,

Chief Inspector of Mines, Etc.

State College of Kentucky,

Lexington, Ky.

I

PRELIMINARY.

During the past year, as in previous years, the correspondence and other clerical work of the office was cared for altogether by the Chief Inspector, while the Assistant Inspector was kept constantly in the field. Contrary to what appears to be a general impression, the Inspector has no clerical assistance, hence the occasional delays of responses to their communications which correspondents may have noted. During the first half of the year, the clerical work was unusually heavy, in consequence of conditions which confronted the writer when he entered upon his duties, toward the end of January. Statistical returns for the preceding year—1901—were in very ragged shape; several of the coal companies were six months in arrears with their reports, and from one company no report at all had been received. Moreover, errors were discovered, in some instances of considerable magnitude, in totals of returns that had been made. Not only was there continued dilatoriness in some quarters with reference to the past-due reports for 1901, but there were, during the earlier months of 1902, unreasonably long delays on the part of some of the companies in making the monthly reports required of them. This necessitated repeated requests for the reports, and in some cases assurances that extreme measures would be taken to procure them were required before complete returns could be obtained. Why this should have been so, the writer is at loss to understand; he is pleased to say, however, that the collection of the monthly reports now proceeds smoothly and with few delays—a reminder as to any delinquency usually bringing a prompt response.

In the matter of filing mine maps due for 1901 there was also an astonishingly large number of delinquents. In some instances it was stated, in response to request for them, that the notice in regard to them which the Inspector is required to send out at the beginning of the year had not been sent. An examination of a "yearly blank," dated November 30th, which the writer's predecessor had mailed to the various companies, shows, however, that the required notice was duly given. The indications at this writing are that the maps due for 1902 will, pretty generally, be filed within the time designated by the law.

In addition to the volume of correspondence on the foregoing accounts, which should have been unnecessary, there was much (which also should have been unnecessary) that grew out of the work of mine inspection. For a time it seemed difficult to convince some of the mine operators that the office was sincere in its expressed determination that the law should be obeyed. It is now believed, however, that all doubts on that point have been dissipated, and that both operators and miners are convinced that the law will be enforced impartially and as fully as the powers and facilities of this office may enable it to command.

AN ADDITIONAL ASSISTANT NEEDED.

But it must be said that an additional assistant is needed. In this opinion, it is believed, all persons (both operators and miners) who are familiar with the present demands upon the office will agree; all who know the proportions to which the coal-mining industry has grown, and who understand what the increase of output from about 3,000,000 tons in 1892, when one assistant was provided, to nearly 6,500,000 tons, in 1902, means. It is evident that greater time is required for the inspection of individual mines, and that there is greater reason for frequent inspections thoroughly made. Moreover, that the mining industry is on the eve of a great expansion, involving a large increase in the number of mines and an extension of the territory to be traveled in passing

from one mining point to another, is beyond question. Within the past two years Morgan county has been added to the inspection list, and the indications are that within the coming two or three years other counties in the Eastern coal-field will be added to the list.

The fact that, under the revised law, the Chief Inspector has duties to perform as Dean of the Department of Mining Engineering in the State A. and M. College, thus placing limitations on the times that he may give to personal inspections of the mines, is also to be considered. It is recommended, therefore, that an additional assistant be provided. It is believed that it would be wise to require, in the act making such provision, that such second assistant, in addition to possessing the necessary qualifications as to knowledge of the different systems of working and ventilating coal mines, and of the properties of noxious and explosive gases, shall have a practical knowledge of mining gained through an experience of at least five years in such mines. While the writer does not concede that, as is often claimed, the position of Assistant Inspector "belongs" to what is understood by the term "practical miners"—believing, on the contrary, that an official position, no less than a private one, should be open to whoever may be fitted to perform its duties—he does agree and thoroughly believes that it is not only right but wise that at least one of the assistants should be selected from members of the craft.

It is also suggested that were provision made whereby temporary, special assistants could be employed, the State College School of Mining Engineering could be made to contribute greatly to the usefulness of this office, and at merely nominal expense to the State.* For the benefit of mine foremen and for others who may desire to broaden the knowledge they have gained through practical experience, by a study of some of the scientific principles governing mining practices, a "short course" is project-

* There is no other Mining School in the State.

ed by the college authorities. Such persons as would take such a course would be eligible for appointment as temporary assistants, to meet some special emergency in their own district, and the cost to the State would be small as regards both compensation and expense of travel.

METALLIFEROUS AND CLAY MINES.

With a force of three Inspectors (a Chief and two Assistants) it would be practicable, as it certainly is desirable, to extend the mining law, with such modifications as are required to fit the respective cases, to the metalliferous, spar, and clay mines of the State. Already, metalliferous and spar mining, of such character as should be under State supervision, has reached considerable proportions, with excellent promise of largely increasing; and there is every probability that in time there will be a marked increase in the number of underground clay mines. There is no good reason why, in the matter of protection to the lives and health of employes, a distinction should be made between coal mines on the one hand, and metalliferous, spar, and clay mines on the other.

At the last session of the General Assembly (1902), a bill applicable to metalliferous, spar, and clay mines was introduced by Hon. M. F. Pogue, of Crittenden county, which should have become a law. It was opposed, the writer understands, by some of those engaged in such forms of mining, upon the ground that it would interfere with the development of their industry; it was believed that it would work hardships on the "smaller prospectors," and would prove harassing to those operating works of some magnitude. Opposition upon such grounds, however, is altogether ill-advised. Instead of proving in any way detrimental to the development of such properties, or in any way acting as an undue restriction upon the operation of such mines, such a law would prove helpful to the owners and operators of the mines, and the work of "prospectors" would in nowise be interfered with; it

would tend to preserve properties from damage due to procrastination in timbering, draining, etc., and to reduce the probabilities of damage suits arising from injuries to employes.

The writer is quite sure that the majority of the coal operators of this State deem the present mining law of much value to them, in that it conduces to good mining methods; and he feels confident that the owners of metalliferous, clay and spar mines would come to so regard a similar law with reference to their mines. The act proposed by Mr. Pogue is as follows:

An Act to provide for the health and safety of persons employed in clay, spar and metal mines in this Commonwealth.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the scope of the duties of the Inspector of Mines be and is hereby extended so as to include clay, spar, and metal mines, and it shall be a part of said Inspector's duty to visit and inspect, not less than three times a year, said inspections to be as nearly as possible not more than four months apart, all the clay, spar and metal mines in operation in this State, and see that the provisions of this act are complied with by the owners, agents and superintendents of such mines. The Assistant Inspector of Mines shall aid in carrying out the provisions of this act.

Sec. 2. Said Inspector and Assistant shall have power to visit and inspect any mine to which this act applies. He shall examine into the condition of such mine with respect to ventilation, drainage, timbering and general security; and if, upon inspection, he finds that such ventilation, drainage or timbering, as the health and safety of the persons employed therein would require, has not been provided, or should he find the mine insecure in any part, or should he find that sufficient means of ingress and egress have not been provided, said Inspector shall at once notify the agent, superintendent, or owner of the mine as to the unsafe or

unwholesome condition of such mine, and require him to put the mine in a safe and wholesome condition, and such mine shall forthwith be rendered safe and healthful. For failure to comply with the directions of the Inspector to render such mine safe, and to provide such ventilation as is sought to be secured by this law, and to provide safe and suitable means of ingress and egress within thirty days from the date of the inspection, the agent or superintendent and owner shall be liable to a fine of fifty dollars (\$50) per day for every day that such mine shall be suffered to remain in such unsafe and unhealthful condition after the expiration of the thirty days above provided in which the required improvement should be made, which fine may be collected by indictment by the grand jury of the county in which such mine is situated; but in cases in which the Inspector is satisfied, from personal investigation, that, even if due diligence is observed, the required improvements can not be completed within the thirty days above provided, he shall have authority to extend the time for not more than twenty days longer; but when the time is thus extended, the agent, superintendent or owner who is delinquent after the expiration of the additional time, shall be subject to indictment and fine as above provided.

Sec. 3. To every mine, worked by shaft, slope, or drift, wherein five or more persons are employed, in which the excavation has extended five hundred (500) feet beyond the original opening, there shall be two separate means of ingress and egress, separated by natural rock, strata or mineral, of not less than one hundred (100) feet in breadth, which separate openings shall be at all times available to the persons employed in such mines; but it shall not be necessary for the two outlets to belong to the same mine. In case any mine has but one opening for the ingress and egress of the men working therein, and the owner thereof does not own suitable ground for another opening, such owner may select appropriate associate adjacent surface ground for that purpose, and have the same condemned, and appropriate the same by proceedings in the county court of the county where the

mine is situated, similar to proceedings now allowed by law for securing a private passway.

Sec. 4. The owner, agent or lessee of every mine, other than an open working, to which this act applies, shall provide and maintain for such mine an amount of ventilation of not less than one hundred (100) cubic feet of air per minute per person employed in such mine, which shall be circulated and distributed throughout the mine in such manner as to dilute, render harmless, and expel the noxious gases from each and every working place in the mine, which ventilation shall be secured by such means as will produce and maintain a steady and abundant supply of air. And at every mine operated by a shaft there shall be provided an approved safety-catch, and a sufficient cover overhead, on all cages used for lowering and hoisting persons, and at the top of every shaft a safety-gate shall be provided, and an adequate brake shall be attached to every drum or machine used in lowering or raising persons in shafts and slopes.

Sec. 5. The owner, agent, lessee or superintendent of every mine to which this act applies shall annually, within seventy (70) days after the first day of January, file with the Inspector of Mines an accurate map or plan of the working of such mine, showing the area mined and the form of the excavations up to the said first day of January, together with the location and connection of such excavations with reference to the lines of all adjoining lands, and the name or names of each owner or owners, so far as known, marked on each tract, a copy of which map shall be kept at the office of such mine. But after the making and filing with said Inspector of the first map of such mine, as required herein, the owner, agent, lessee or superintendent shall only be required to annually make and file with said Inspector within the time specified, such additional map as may be necessary to show the progress of the workings and amount of excavation of said mine from the date of the preceding map or survey up to the first day of January, as provided herein. The Inspector shall annually, on or before the first day of January, give warning notice that such

map is required; and upon failure or refusal of the owner, agent, lessee or superintendent receiving such notice to file such map as herein required with the Inspector within the seventy days herein specified, said owner, agent, lessee or superintendent shall be liable to a fine of five dollars per day for each day elapsing until said map is filed as herein required, said fine to be recovered in the county in which the mine to be mapped is situated. The correctness of each map provided for by this section shall be certified by the person making such map, and the Inspector may reject any map as incomplete, the accuracy of which is not so attested.

Sec. 6. The Inspector of Mines shall keep a record of all the inspections made by him and by the Assistant, and shall furnish a certified copy of the report of the inspection of any mine inspected to the Commonwealth's Attorney of the district in which the mine is situated, on application therefor, which copy shall be admissible in evidence in any court in this Commonwealth, and shall be *prima facie* evidence of the truth of recitals therein contained.

Sec. 7. In his annual report to the Governor, the Inspector of Mines shall make report of the condition and operation of all the mines to which this act applies, enumerating all accidents which shall have occurred in or about the same; also reporting the number of persons employed, the days worked, and the amount of mineral mined; and giving such other information as he may deem useful. And for the purpose of enabling him to make such report, the owner, agent, lessee or superintendent of every mine to which this act applies is hereby required to give, semi-annually, on blanks to be furnished by the Inspector, accurate information as to all accidents occurring in and about the mines, the number of persons employed in and about the mines, the number of days worked, and the amount of mineral of each kind mined during the preceding six months; and the owner, agent, lessee or superintendent refusing or failing to furnish the Inspector such information for sixty days after application therefor has been received, shall be liable to a fine of fifty dollars, to be recovered in

the county in which the mine, concerning which such information is refused, is situate. And said Inspector shall be furnished with all necessary stationery and postage as other offices are supplied.

Sec. 8. This act shall take effect ninety days after adjournment of this session of this General Assembly.

MINERS' OIL LAW.

For years, beginning in 1892, and repeated in nearly every report issued since that year, this office has called attention to the desirability of a law regulating the character of oil used in the mines of the State. That a great deal of it is simply vile is a matter of universal knowledge, and many of the mining companies will freely acknowledge that the quality of oil used is far below what, under proper conditions, it should and would be. Coal companies are far less to blame for the poor quality of oil used than appears on the surface. The root of the evil lies in the fact that Kentucky is now one of the very few mining States in which the compounders of the "cheap," nasty, soot-producing oils are permitted to sell their product. The better oils cost the miner more per gallon (and yet they are cheaper in the long run), and when a coal company undertakes to sell to its men the better grades, it soon finds itself threatened with a rival who sells the compounded stuff at so much less per gallon that, to save its oil trade, the company is itself practically driven into the "cheap oil" business. There may be companies that find more profit in the inferior oils, and sell them through preference, but for such the writer does not speak. There is but one effective way in which to deal with the question, and that is to absolutely prohibit the sale of miners' oil below a certain standard anywhere in the State. So long as these inferior, compounded oils are allowed to come into the State, so long will they be sold by mining companies, and so long will the mines be filled with clouds of soot and loads of carbonic acid that defy the efforts of even the best of foremen to give their mines thorough ventilation.

At the last session of the General Assembly, Hon. R. B. Brad-

ley, of Hopkins county, introduced a bill designed to remedy the evils complained of. Unfortunately, the measure was introduced at such late date that there was insufficient time in which to secure its passage through both Houses. Mr. Bradley's bill, for which favorable consideration is hoped from the next General Assembly, is as follows:

MR. BRADLEY'S OIL BILL.

An Act to improve the condition of miners by preventing the use of inferior illuminating oils in mines in this Commonwealth.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

Section 1. That only a pure animal or vegetable oil, or other material as free from smoke as a pure animal or vegetable oil, and not the product or by-product of resin, and which has been inspected and complies with the following test, shall be used for illuminating purposes in the mines of this State: All oil must be tested at 60 degrees Fahrenheit; the specific gravity of the oil must not exceed 24 degrees Tagliabue; and should the oil be 45 degrees and below 60 degrees Fahrenheit, it must be raised to a temperature of about 70 degrees Fahrenheit, when, after being well shaken, it should be allowed to cool gradually to a temperature of 60 degrees Fahrenheit before finally being tested. In testing the gravity of the oil, Tagliabue hydrometer must be, when possible, read from below, and the last line which appears under the surface of the oil shall be regarded as the true reading. Where the oil is tested under different circumstances, an allowance of one-half degree may be made for possible error in parrallax before condemning the oil for use in the mine.

Sec. 2. In every county where one hundred or more men are employed in mining coal or other minerals under the surface of the earth, where illuminating oil is required, the State Mine Inspector shall appoint a reputable person of the age of twenty-one years or over, who shall be known and designated as inspector

of miners' oil, who, before entering upon the discharge of his duties, shall go before the county judge or clerk and take the oath required by officers in this Commonwealth and give bond in the sum of two hundred dollars for the faithful performance of his duties.

Sec. 3. It shall be the duty of the inspector of miners' oil to inspect all miners' oil, or oil used for illuminating purposes in mines, which may not have been previously inspected by an authorized inspector of miners' oil in this Commonwealth, and when said oil complies with the requirements or test of the first section of this act, he shall stencil each barrel, cask or package so inspected as follows:

"Approved this....day of.....by Inspector....."

The blank to be filled out with the date and the name of the authorized person making the inspection; but if the oil does not come up to the tests specified in this act, the barrel, cask or package in which it is contained shall be branded:

"Rejected for illuminating purposes in the mines of the State of Kentucky....day of.....by Inspector....."

He shall keep a record showing number of barrels or gallons inspected, whether approved or condemned, and give date, place of business and name of person, firm or corporation for whom inspection is made, and shall render quarterly statement to the State Mine Inspector upon blanks furnished by him for that purpose.

Sec. 4. The firm, person or corporation for whom inspection is made shall pay the inspector the sum of one-half cent a gallon for all oil he inspects in lots of 5,000 gallons or over, and one cent a gallon for lots of less than 5,000 gallons, and any cost of transportation that the inspector has to pay, by reason of his going to places other than the town where he makes his headquarters.

Sec. 5. Upon complaint of two or more persons, it shall be the duty of the inspector of miners' oil to inspect oils being used by miners, to determine if the grade is of the standard described in section 1 of this act. Should he find the grade of oil used below

the grade fixed in this act, he shall notify the owner, agent or operator of the mine and also notify the miners using the oil that the quality is inferior, and if change is not made as soon as practicable he shall notify the prosecuting attorney of the county in which the mine is located, giving him all the facts, and the prosecuting attorney shall forthwith proceed to enforce the provisions of this act.

Sec. 6. Any person or persons, firm or corporation which ships any oil contained in any barrel or barrels, package or packages which are not branded as prescribed in section 3, said oil to be used for illuminating purposes in coal or other mines, and any person or persons, firms or corporations which sell any oil other than that prescribed in section 1 to be used for illuminating purposes in the mines, and any person, firm or corporation having in charge the operation or running of any mines under his or its charge, uses or permits the use of any oil other than that prescribed in section 1, and any miner or mine employe who uses, with the knowledge of its character, in any mine of this State, any oil other than that prescribed in section 1 shall be guilty of a misdemeanor, and on conviction shall be fined not less than five dollars nor more than fifty dollars; each person convicted of a second or other offense of this act shall be fined not less than fifty dollars nor more than one hundred dollars, or shall be imprisoned in the county jail not less than ten days nor more than three months, or by both such fine and imprisonment. Justices of the peace shall have jurisdiction to try any violation of this act.

MINE MAPS.

Reference has already been made to the tardiness exhibited in filing mine maps for 1901, and to the more satisfactory promise so far indicated with respect to those due for 1902. It is desired here only to call the attention of mining engineers, and of such other persons as may be employed to make maps of the mines, to the requirement of the law in regard to the character of maps to be filed. The law requires that the map shall be a map in fact—

not a mere sketch or survey of entries; it is required that the maps shall show *the form and extent of all the excavations*, which of course includes the rooms; and the accuracy of the map must be certified to by the person making it. It is to be presumed that no mining engineer needs to be told what constitutes a mine map, and what sort of a map is, therefore, to be filed with this office; and yet so-called maps have been received within the year from unquestionably competent engineers, which showed entries only, and which, in event of disasters, would prove of very little value; while for working purposes and for the enlightenment of this office as to conditions in the excavated portions of the mine, they are of no value whatever. When such "maps" were rejected, and attention called to the requirements of the law both as regards character of map and certification, real maps were furnished. The rejection of maps by this office should not be rendered necessary, and it is hoped that hereafter engineers will not undertake to send in what they know are not maps of their mines, and what they must know will be rejected. Other plans, designated as "maps," have been sent in which were failures simply through lack of knowledge on the part of those engaged to make the mine map; some bore evidences of a certain amount of surveying, and others were excellent examples of what a neat bookkeeper can do, with his rule and red-ink pen, when gifted with an artistic imagination and untrammelled by survey notes.

But rejections on the score of inadequacy are the exception; the complaint here made is not based so much upon defective plans as upon the failure to certify to the maps sent in. As a rule, the requirement as to certification has been overlooked, notwithstanding the fact that attention was called to it in the "map-due notice" sent out January 1st. It is hoped that this reminder will prove sufficient, and that hereafter care will be taken to fully comply with section 8 of the law.

II.

STATE GEOLOGICAL DEPARTMENT.

The widespread interest manifested in the State's mineral and other natural resources by legitimate investors—by those whose investments mean development—is well illustrated by the voluminous correspondence of this office. There is a constant stream of requests for geological reports and maps, and for special information concerning various mineral deposits.

Naturally, and especially since the inauguration of the great strike in the anthracite fields, which has brought a large section of the country, hitherto dependent upon those fields for fuel, face to face with the fact that it must prepare to use more and more of the softer coals, the chief subject of inquiry is coal.

Information concerning our petroleum districts is also eagerly sought, interest in the oil possibilities of the State being secondary only to that manifested in regard to the coal fields. Judging from the developments now under way and the indications as to further activity given in the correspondence of the Department, it would appear that the prediction made by the present writer eight years ago,* namely, that "the shipment of petroleum will eventually become one of the most important industries of the State," and that "Kentucky is to be one of the leading petroleum producing States"—is in a fair way to be verified. No doubt there is just now a tendency toward "over booming" and toward exaggerated expectations here and there; but that the general results of developments already in progress are such as to justify great confidence in the value of our petroleum regions, seems beyond question. Up to this time the attention of oil men has been

* Report of 1894, pages 174 and 175.

given almost exclusively to the eastern and south-central parts of the State; but the writer believes that there are regions in the western part that well deserve intelligent, systematic prospecting.

Our lead, zinc, and spar (barite and fluorite) deposits are receiving renewed attention, and many inquiries are received concerning them. The occurrence of such deposits in commercial quantities, whenever favorable trade conditions should obtain and render feasible a scheme of development based upon the marketing of all the vein materials, has been known for many years. Serious attempts to work them, both in the western part of the State and in Central Kentucky, were made thirty years ago. Operations, however, were founded solely upon the possible lead contents of the veins, and, in the then rather crude state of concentrating processes, mining in our veins, based on that one metal, was found to be impracticable. Moreover, even had the disposition been to utilize all the vein material—as certainly would have been the case had circumstances been favorable—trade conditions, no less than the imperfections of then existing ore dressing appliances, were against the Kentucky deposits. The West was producing an abundance of cheap lead; zinc blende had at our mines comparatively little value and was regarded with disfavor in all the lead regions of this country; and the demand for fluorite (the prevailing veinstone in Western Kentucky), and barite (the prevailing veinstone in Central Kentucky), was very small. Under the altered conditions prevailing in recent years, however, the Kentucky deposits have again come to the front, and considerable progress has been made in their development, along new lines, within the last two years. The Western District, a preliminary report upon part of which is printed in another part of this report, has been the principal seat of reviving activities.* Considerable work has also been carried on in the Central Kentucky District, but upon the whole much less has been done toward proving the possibilities of the Central District

* It is believed by the writer that lead, zinc and fluorite have a wider distribution in Western Kentucky than is generally supposed.

than has been accomplished in the Western one. The most serious difficulty to be overcome in the development of our lead and zinc resources, as the writer believes, is as regards separation of the fine-grained zinc (sphalerite) from the gangue minerals. When that problem on concentration is satisfactorily solved, as it doubtless will be, our deposits will unquestionably prove of great value.*

Interest is growing in our clay deposits, and also in our stores of building stone, but not at such a rate as their importance really warrants. Kentucky is, beyond question, a great clay State; our clay deposits are in value second only to our coal deposits; and yet, as regards production either of raw material or of manufactured articles, the State is almost a virgin field for the investor. The writer believes that the limited interest manifested in regard to our clay resources is due entirely to lack of general information concerning them; and, unfortunately, no special report on them has ever been made.

Numerous inquiries were received during the year in regard to materials suitable for the manufacture of Portland cement. No special investigation of this subject having been made during the life of appropriations for geological work in the State—examinations and analyses of limestones, clays and shales being confined, at such times, to questions relating to fitness for building purposes, for the manufacture of wares, and for use as fertilizers—the writer has been greatly embarrassed, through lack of analyses, in the effort to supply the information desired. He has been able to name localities where proper limestones could be obtained, but could not advise as to the clays or shales near-by, since analyses of them are not at hand; and he has been able to point out suitable deposits of clay or shale, but could not advise as to the

* Those engaged in prospecting and developing the lead, zinc and spar regions may be interested in the fact that the equipment project of the ore dressing laboratory of the State College School of Mines has been conceived with especial reference to the practical study of concentrating problems in our lead and zinc districts. A "Wilfley" table of the latest design has been procured, and it is proposed not only to make the laboratory of practical value to the mining interests of the State, as a testing laboratory, but to place its facilities at the command of any mining engineers and metallurgists of Kentucky who may wish to carry on investigations in person.

near-by limestone, because of lack of analyses. It is well established that the white oolitic limestone of the Lower Carboniferous (commonly called Sub-Carboniferous), is almost if not quite invariably suited for the purpose. But that stone is usually of more value as a building stone, and it would be best to look to the blue and grey stones, should it prove that suitable material may also be obtained from such beds. Unfortunately, few analyses of such beds are at command. Manifestly there is much yet to be learned concerning the distribution and individual characteristics of the cement materials of the State, and it should be said that the study of this important question, to be of real value, must be conducted along "practical" lines. That is to say, having ascertained by chemical analyses the probabilities as to fitness for cement mixtures of neighboring deposits of limestone and shale, their actual values can only be determined by subjecting mixtures consisting of various proportions (as may be indicated by analysis) to burning tests under controlled heats. As is well known by cement makers, a mixture of given materials which at one heat fails to produce a good cement, may at another temperature produce an excellent article; and the experiments necessary to determine such questions must be made under conditions closely representing those that will govern operations conducted on the commercial scale—thus calling for provisions that are usually beyond the resources of the ordinary chemical laboratory. It is believed that the civil engineers, architects, and others engaged in construction work, would welcome an investigation which would lead to the development of cement industries in the State. It is quite certain that the State itself would greatly profit by such work.

One of the most striking features of the correspondence of the Department is the lack of interest shown in regard to our stone deposits. The writer believes that this is due most largely to the fact that very little has ever been published concerning our resources in stone. This omission should be supplied at the earliest time possible. Kentucky should be one of the leading sand-

stone and limestone producing States, instead of standing well toward the bottom of the list. It is a matter of especial interest to know that the most important quarry of lithographic stone operated in this country is in Kentucky.

During the year many consignments of specimens for identification were received. In comparatively few instances were the materials of particular value, since the specimens sent consisted principally of supposed gold, silver or copper ores, which, upon examination, proved to be no more than common pyrites. There were exceptional cases, however, where specimens received proved to be minerals of value—notably, galena, zinc carbonate, rich blende, and beautiful, perfectly white clay (halloysite?). So far, no specimens sent to this Department, whether of galena or other mineral, have shown even a trace of gold, or more than a mere trace of silver. The sending of specimens for determination as to their nature and value is heartily encouraged, the fact being recognized that in such way discoveries of valuable mineral deposits, which otherwise might escape attention, may be promoted.

Many requests for free assays are received. Even were it practicable, as regards time at the disposal of the Curator, to grant such requests, this Department is not now equipped with the necessary apparatus for such work. There is no longer even a blowpipe outfit in the office, the set formerly used having in some way become broken and in part lost. It has been necessary, therefore, in all cases where chemical tests were required, for the Curator to have recourse to the laboratory of the State Experiment Station, and he takes pleasure in here making acknowledgments to Prof. M. A. Scovell, Director, and to Dr. A. M. Peter for their unvarying courtesy toward this Department, and for their kindness in making all chemical examinations requested.

REPORTS AND MAPS EXHAUSTED.

As already indicated, the daily mail of the Department is loaded with applications for geological reports and for maps. Unfortunately, the editions of many of the reports are exhausted, and the only maps available for distribution now remaining are such as cover certain counties or limited districts. The edition of the State map, showing the distribution of the geological formations, which is the one most sought, has been exhausted for some years. The writer is making every possible effort to meet the demand for information concerning the State—sending such printed matter as is available for regions especially designated, copying matter from reports that are out of print, and preparing special statements based on his own unpublished notes; but it is not possible to cover the ground satisfactorily in such way. Several of the reports should be reprinted, manuscript reports now in the office should be published, and a new edition of the State geological map should be issued.

Even such reprints, however, would serve only for temporary purposes, since the reports, which, as a rule, are of a general and preliminary nature, were prepared twelve to fifteen years ago, and, although still of great value, require revision. Not only is an up-to-date series of reports on the economic geology of the State needed, but the first reports issued should relate to subjects applying to the State as a whole, rather than to regions. We need, for example, a special and comprehensive report on our coals, applicable to the State as a whole; a similar one on the clays; a similar one on the building stones, and so on; and there should be one on our water-powers, concerning which there are practically no data at the service of the public, and a more comprehensive one on the timbers of the State than we now have.

CO-OPERATION WITH U. S. GEOLOGICAL SURVEY.

By means of subscriptions placed at his command as Curator of the State Geological Department, the writer was enabled to enter into an agreement with the U. S. Geological Survey for co-operative geologic and topographic surveys in portions of the eastern and western parts of the State during the past year, and for elaborate topographic work in the upper Cumberland Valley during the year 1903. By the terms of the agreement, the U. S. Geological Survey expends an amount in such work equal to that allotted by this Department. Under the agreement, the lead, zinc and fluor-spar regions in Caldwell, Crittenden and Livingston counties were examined. In the upper Cumberland Valley an area of about 600 square miles was laid out to be surveyed geologically and topographically. The geologic work was nearly completed in 1902. The topographic work will be completed in 1903. The administrative reports relating to each district are presented elsewhere in this report, as is also a preliminary statement concerning the lead, zinc and fluor-spar regions named above.

In regard to the cooperative work which has thus been arranged for, it may be said that, although the Curator's half of the necessary funds was received in the form of subscriptions from various parties interested in the districts surveyed, the work is carried on precisely as if all funds came from the public treasury, and in the same manner that obtains in all properly conducted public surveys, whether State or Federal; no attention is paid to boundary lines, no private information is given out, and no reports are made to contributors to this Department's part of the expense fund in advance of the published reports submitted to the public. Moreover, in order that the areas in which contributors are interested might be included in the surveys (which necessarily are laid out in a systematic way, without reference to private boundaries, save to the extent of including given areas), contributors have been required to furnish funds for very much more territory than they have any interest in.

Undertaking cooperative work with the U. S. Geological Survey by means of subscriptions has been a matter of necessity, not of choice. Such subscription method is neither desirable, since it is not sufficiently flexible, nor of wide application, since there are comparatively few who are willing to make contributions under the terms outlined above. The writer has encouraged it, however, until an appropriation for resumption of geological survey work by the State officials, including cooperation with the U. S. Geological Survey, can be obtained through action of the General Assembly. The action of those who have contributed from their private means the funds for undertaking the operations of the past and present year affords striking proof of the earnest desire for information of a more detailed nature than we now have concerning the State's resources. Coupled with the facts stated as to the demands made upon this Department for reports and maps, it emphasizes the necessity for resuming geologic and topographic field-work by the State.

PROPOSED SURVEY BILL.

It is hoped that the next General Assembly, recognizing the necessity for a thorough study and description of the State's natural resources, will grant such an appropriation as will enable the Curator to take up such work and conduct it along such lines as will prove of most immediate service to the State. The outlines of such a measure as would, in the writer's opinion, most effectively and economically accomplish the purposes desired, are as follows:

1. There should be no expense for administration, since the conduct of the work would be under the direction of the Curator of the Geological Department, whose salary is already provided for.

2. Provision should be made for the necessary geological and other assistants, whose salaries should be fixed by the Governor, but should not exceed a maximum sum per diem stated in the act.

3. Rigid safeguards should be provided with reference to the rendering of expense accounts by persons employed in the work; and the director of the work should be required to keep an itemized account of all expenditures, of whatsoever kind, and submit the same, quarterly, to a supervisory board, consisting of the Governor, Secretary of State and Auditor, for their inspection and approval.

4. It should be explicitly and plainly set forth that the especial work of the survey shall be to study and report upon the economic geology of the State, investigations of purely "scientific" interest, holding, for the time, only an incidental relation to the work. The act should, therefore, require that particular attention be given to ascertaining the location, extent and actual fitness for commercial uses of the various mineral substances in the State, their relations to transportation routes, actual and possible, and the feasibility of mining them. All determinations of the values of stones, cement materials, clays, shales, etc., should include the standard, practical tests required in business operations. Provisions should be made for the study of soils, water-powers and timbers.

5. The reports of the survey should be divided into three classes, namely: (1) Subject Reports; (2) County Reports, and (3) a General, or Index, Report.

The Subject Reports should be the ones first issued, and should consist of a series of bulletins, each report dealing with some particular mineral occurrence, or particular subject, and treating it in a thorough, exhaustive way with reference to its occurrence throughout the State. There should, therefore, be issued a special report on the coals of the State, which might be divided into two parts, one on the coals of the eastern field and one on those of the western field; a similar report on the building and ornamental stones of the State as a whole; one on the clays, shales and cement materials; one on petroleum and natural gas; one on road materials, and so on, appropriate bulletins being issued with reference to the various subjects of

investigation coming within the province of the survey. The publication of preliminary parts of a bulletin, covering the special work so far as it has advanced, in advance of the completion of the entire bulletin, should be permissible in cases of urgency.

The County Reports should consist of full and complete reports on the mineral, agricultural and other natural resources of each county, with accurate maps and diagrams exhibiting the distribution and lay of the geologic formations.

The General, or Index, Report should, as the name indicates, relate to the distribution of the geological formations and mineral and agricultural resources of the State as a whole, serving as an index to them, with citations to the special bulletins and county reports wherein extended descriptions may be found.

6. The same provisions should apply to the printing of the survey publications that obtain with respect to printing other official reports of the State. The first edition of each report should consist of not less than 1,000 copies, and the Commissioners of Public Printing should be authorized, upon recommendation of the Governor, to print new editions when needed, all reprinted reports to be sold at a small advance above the cost of reprinting. The Commissioners should also be authorized to reprint copies of the older reports and maps, the editions of which may be exhausted, whenever in their judgment the public demand for such reports justifies such reprinting, the reprinted copies to be sold as in the case of second editions of later reports. Receipts from all sales should be placed to the credit of the general revenue. Provision should also be made for the publishing of manuscript reports and maps now in the archives of the Geological Department.

7. The Curator, as director of the State Survey, should be authorized to enter into agreement with the Director of the U. S. Geological Survey for cooperative topographic and hydrographic surveys, the basis of the agreement being that the U. S. Geological Survey shall expend in each case of work agreed upon an amount equal to that allotted for such work by the State Survey.

8. Report should annually be made to the Governor, to be transmitted to the General Assembly, showing the progress made by the survey, and giving account, under proper heads, of all expenditures and for what purposes such expenditures were made.

9. Rigid provision should be made, prohibiting any official or employe of the survey from engaging in land speculations or in buying or selling mineral lands, from giving private information concerning discoveries made in the progress of the survey, and from making special reports on mineral properties for private persons or for corporations.

10. A reasonably liberal sum should be appropriated, in order that the work of the survey may be carried on most effectively and expeditiously. However economical may be the administration, ultimate economy is not promoted by making annual appropriations so small that but little ground can be covered each year. Included in the allotments for the various branches of investigation should be a special sum for cooperation with the U. S. Geological Survey.

It is intended that in due time a carefully considered bill, embodying the foregoing suggestions properly elaborated, shall be prepared, which it is hoped may be received with favor by the General Assembly.

III.

COMMERCIAL MINES.

On January 1, 1903, there were in operation 138 mines, operated by 103 companies. The following list shows the names of the operators and of the counties in which the mines are situated, the character of the openings, and the postoffice address of each mine. In some cases the principal office is not at the mine; the address of that office will be found in the descriptions given in the chapter headed "Notes on the Mines."

GENERAL LIST OF MINES.

NAME OF OPERATOR.	Mine Office.	County.	No. of Mines.	Opening.
Pineville Coal Co.	Wallsend	Bell	8	Drifts.
National Coal and Iron Co.	Straight Creek	"	2	"
Black Raven Coal Co.	Four Mile	"	1	"
Bennett's Fork Coal Co.	Middlesboro ..	"	1	"
Excelsior Coal Mining Co.	Excelsior	"	1	"
Sagamore Coal Co.	Middlesboro ..	"	1	"
Tuckehoe Coal Co.	Four Mile	"	2	Sl. & Dr.
Ashland Iron and Mining Co. (No. 6)	Rush	Boyd	1	Drift.
Ashland Iron and Mining Co. (No. 11)	"	"	1	"
John Wurts, Lessee (Clinton 8)	Ashland	"	1	"
John Wurts, Lessee (Winslow 1)	"	"	1	"
Princess Land and Mining Co.	Princess	"	1	"
Kentucky Union Co.	Jackson	Breathitt ..	2	"

GENERAL LIST OF MINES.—Continued.

NAME OF OPERATOR.	Mine Office.	County.	No. of Mines.	Opening.
B. Baker, Lessee, Aberdeen C. & M. Co.	Aberdeen	Butler	1	Drift.
West Aberdeen Coal Co.	Morgantown ...	"	1	"
Eastern Kentucky Ry. Co. (Lost Cr.) .	Willard	Carter	1	"
Ashland Iron and M'g Co. (Bailey 1).	Rush	"	1	"
Ashland Iron and M'g Co. (Rush 10).	"	"	1	"
Strait Creek Coal Co.	Denton	"	1	"
Kentucky Cannel Co. (Boghead)	Grayson	"	1	"
Adkins Coal Co. (Meadow Br.)	Rush	"	1	"
Empire Coal and Mining Co.	Empire	Christian ..	1	Shaft.
New Holland Coal Co.	Owensboro	Davless	1	Slope.
Owensboro Coal and Mineral Co.	"	" ...	1	Drift.
M. H. Enright (Falcon)	Adair	Hancock ...	1	"
Auburn Ash Coal Co.	Fenley	" ...	3	"
Pittsburg Coal Co. (Baskett)	Baskett	Henderson .	1	Shaft.
Arnold Coal Co. (Rankin)	Spottsville	" ..	1	"
Corydon Coal Co.	Corydon	" ..	1	"
Henderson M'g and Mfg. Co.	Henderson	" ..	1	"
Peoples Mining Co.	"	" ..	1	"
Carbondale Coal and Coke Co.	Hamby Station	Hopkins ...	1	Drift.
Crabtree Coal Mining Co.	Ilisley	"	1	"
Oak Hill Coal Co.	Nortonville	"	1	"
St. Bernard Mining Co. (No. 9)	Earlington	"	1	Slope.
St. Bernard Mining Co. (No. 11)	"	"	1	Dr. & Sh.
St. Bernard Mining Co. (Hecla)	"	"	1	Slope.
St. Bernard Mining Co. (Arnold)	"	"	1	Drift.
St. Bernard Mining Co. (Diamond) ..	Morton's Gap .	"	1	"
St. Bernard Mining Co. (Barnsley) .	Barnsley	"	2	"
St. Bernard Mining Co. (St. Charles).	St. Charles	"	2	"
Reinecke Coal Mining Co.	Madisonville ..	" ...	1	Shaft.
Victoria Coal Co.	" ...	"	1	"

GENERAL LIST OF MINES—Continued.

NAME OF OPERATOR.	Mine Office.	County.	No. of Mines.	Opening.
Nortonville Coal Co.	Nortonville	Hopkins ...	1	Shaft.
Whitehouse Cannel Coal Co.	Myrtle	Johnson....	2	Drifts.
Sandy River Coal Co.	Eliza	"	1	"
North Jellico Coal Co. (Bertha)	Bertha	Knox	2	"
North Jellico Coal Co. (Wilton)	Wilton	"	1	"
North Point Jellico Coal Co.	Gray	"	1	"
Ross Jellico Coal Co.	"	"	1	"
Artemus Jellico Coal Co.	Artemus	"	1	"
East Jellico Coal Co.	Coalport	"	1	"
Hughes Jellico Coal Co.	Flat Lick	"	1	"
Pittsburg Coal Co.	Pittsburgh	Laurel	2	"
Laurel Coal Co.	"	"	2	"
Pitman Coal Co.	"	"	1	"
G. W. Curvin	Viva	"	1	"
Standard Coal Co.	"	"	1	"
Bastin Coal Co.	East Bernstadt	"	1	"
New Star Coal Co.	"	"	1	"
Manchester Coal Co.	"	"	1	"
Altamont Coal Co.	Altamont	"	1	"
New Diamond Coal Co.	Altamont	Laurel	1	Drift.
Leota Coal and Coke Co.	Lily	"	1	"
Peach Orchard Coal Co.	Peach Orchard	Lawrence ..	2	"
Torchlight Coal Co.	Walbridge	" ..	1	"
McGuire Coal Co.	Beattyville ...	Lee	1	"
L. C. Norman & Sons	" ...	"	1	"
Contrary Creek Coal Co.	" ...	"	1	"
Memphis Coal Co.	Island	McLean	1	Slope.
Green River Coal Co.	"	"	1	Shaft.
Biggstaff Cannel Coal Co.	Biggstaff	Morgan ...	1	Drift.
Kentucky Block Cannel Coal Co.	Cannel City ..	" ...	1	"

GENERAL LIST OF MINES—Continued.

NAME OF OPERATOR.	Mine Office	County.	No. of Mines.	Opening.
Central Coal and Iron Co. (Central) .	Central City ..	Muhlenberg	1	Shaft.
Central Coal and Iron Co.	Powderly	"	1	"
Hillside Coal Co.	Mercer Station	"	1	"
Oakland Coal Co.	"	"	1	"
Dovey Coal Co.	"	"	1	"
Crescent Coal Co.	Bevier	"	1	"
Bevier Coal Co.	Cleaton	"	1	"
S. J. Gish	Central City ..	"	1	"
W. G. Duncan Coal Co.	Luzerne	"	1	Drift.
Black Diamond Coal and Mining Co.	Drakesboro ...	"	1	Shaft.
Mud River Mining Co.	Mud River	"	1	Slope.
Taylor Coal Co.	Taylor Mines .	Ohio	1	Drift.
Williams Coal Co.	McHenry	"	1	"
McHenry Coal Co.	"	"	1	Slope.
McHenry Coal Co.	Echols	"	1	Shaft.
Central Coal and Iron Co.	Render	"	1	Drift.
Fordsville Block Coal Co.	Fordsville	"	1	"
Green River M'g, Mfg. and Tr. Co.....	Coffman	"	1	"
Deanefield Coal Co.	Aetnaville ...	"	1	Shaft.
Deanefield Coal Co.	" ..	"	1	Slope.
Indian Head Coal Co.	Parker's Lake .	Pulaski ...	1	Drift.
Paris Coal Co.	" ..	" ...	1	"
Eagle Coal Co.	Barren Fork ..	" ...	1	"
New Cumberland Coal Co.	McGuffey	" ...	1	"
Nixon Coal Co.	Flat Rock	" ...	1	"
Alpine Coal Co.	Alpine	" ...	1	"
Ohio Valley Coal and Mining Co.	DeKoven	Union	1	Slope.
Morganfield Coal and Mining Co.	Morganfield ...	"	1	Shaft.
United States Coal, Coke and Gas Co.	Sturgis	"	1	Slope.
Tradewater Coal Co.	"	"	1	Shaft.

GENERAL LIST OF MINES—Continued.

NAME OF OPERATOR.	Mine Office.	County.	No. of Mines.	Opening.
Ben. C. Davidson & Sons	Unlontown ...	Union.....	1	Shaft.
American Coal and Iron Co.	" ...	"	1	"
Providence Coal Co.	Providence ...	Webster ...	1	"
Providence Coal Co.	"	"	1	Slope.
Sebree Coal Co.	Sebree	" ...	1	Shaft.
Shamrock Coal Co.	Providence ...	" ...	1	"
Wheatcroft Coal and Mining Co.	Wheatcroft ..	" ...	1	"
Wheatcroft Coal and Mining Co.	"	" ...	1	Slope.
Louisville Property Co.	Halsey	Whitley ...	8	Drifts.
East Tennessee Coal Co.	Jellico, Tenn. .	"	2	"
Mt. Morgan Coal Co.	Williamsburg .	"	1	"
Cockill Coal Co.	" .	"	1	"
Main Jellico Mountain Coal Co.	Kensee	"	2	"
Jellico Coal Mining Co.	Mountain Ash	" ...	2	"
Procter Coal Co.	Red Ash	"	4	"
C. C. Cordell & Co.	Pine Knot	"	1	"
Hoffman & Berry	Williamsburg .	"	1	"
Watts Creek Jellico Coal Co.	Wofford	" ..	1	"
West Jellico Coal Co.	Strunk	"	1	"
Pineknott Coal Co.	"	"	1	"

NEW AND IDLE MINES.

During the year 1902 twenty new mines were opened or old ones reopened, and twelve mines were abandoned or suspended temporarily. Following are the new mines:

NEW MINES.

Bell County.—The Sagamore Coal Co., of Middlesboro, J. J. Robertson, President, A. M. Chamberlain, General Manager, Secretary and Treasurer, began opening a mine in the autumn. When visited November 28th, the drift had been driven in 50 feet.

Butler County.—The West Aberdeen Coal Co. was opening a new mine in November, the old one being about exhausted. On November 12th the main entry had been driven in about 300 feet.

Crittenden County.—The Hillman Land & Iron Co. reopened the old Bell mine and sank a shaft 250 feet deep to catch the Bell coal two miles south of Sturgis.

Hancock County.—The Auburn Ash Coal Co. opened a mine at Fenley. (See Notes on the Mines.)

Hopkins County.—The Nortonville Coal Co. opened a mine near Nortonville; a shaft 50 feet deep. Officers are: Frank M. Fisher, President; John B. Trice, Vice-President; John T. Edmunds, Secretary; Ira L. Smith, Treasurer; Walter S. Elgin, General Manager; Hugh Monahan, Mine Superintendent.

Knox County.—The Ely Coal Co. opened a mine at Ely's and commenced shipments in January. The property was purchased by the Hughes Jellico Coal Co. in March. See Notes on the Mines.

The North Jellico Coal Co. opened its Wilton mine for regular shipments early in the year, though a small amount of coal was produced in entry driving in December, 1901.

Johnson County.—The Whitehouse Cannel Coal Co. opened a mine in a second seam, and expected to be making shipments from it by February, 1903.

Laurel County.—The Laurel Coal Co. made a new opening, the old one being nearly exhausted.

G. W. Currin made a new opening to replace the old one, which was abandoned.

Lee County.—The Contrary Creek Coal Co. opened a new mine at about the close of the year.

McLean County.—The Green River Coal Co. reopened the Island Shaft. See Notes on the Mines.

Muhlenberg County.—S. J. Gish opened a shaft mine in No. 9 coal, about three miles west of Central City. In December he had driven 60 feet from the bottom of the shaft, and was sinking another shaft, the latter lacking about 20 feet of being down to the coal. A coal cutting plant, comprising a Norwalk, 14 by 12, compressor, and four Harrison pick machines, had been installed.

Pike County, Etc.—Many inquiries have been received concerning the operations of the Northern Coal & Coke Co., in Pike, Johnson, Floyd and Letcher counties, since it is realized that the opening of the Elkhorn coking field by that company means much in the development of the Eastern coal field. As yet the company has opened no mines—though it has done a vast amount of prospecting and has made very many coal openings to prove the character and thicknesses of the various seams on its great property. The plans of the company have not sufficiently progressed for it to state whether or not it expects to open mines at an early date, or when it expects to do so. This will depend upon railroad transportation which is now wholly lacking. The road being built to the field will not be completed and ready for business before the summer or fall of 1904, if then. For this reason the company is in no hurry to take steps for development, but it will be ready by the time the railroad is completed. The company has built no ovens, except a small battery for testing purposes. Officers of the company are as follows: P. L. Kimberly, President; J. W. M. Stewart, General Manager; F. A. Daley, Secretary and Treasurer; Directors—F. H. Buhl, Sharon, Pa.; Geo. W. Couch, Charleston, W. Va.; G. C. Howe, Duluth; P. L. Kimberly, Chicago;

Frank Lane, Cincinnati; J. R. Thomas, Charleston, W. Va.; J. D. Williams, Duluth. Main office, Pikeville, Ky. The company is capitalized at \$1,500,000.

Pulaski County.—The Indian Head Coal Co., successor to the Indian Creek Coal Co., opened a new mine in October, to replace the old one, which was abandoned. See "Notes on the Mines."

The Nixon Coal Co., successor to the Cogar Creek Coal Co., opened a new mine in November, to replace the old one which was abandoned.

Union County.—The Morganfield Coal & Mining Co., W. H. Lloyd, Superintendent, commenced sinking a shaft at Morganfield, to catch No. 11 coal. Recent advices are that the shaft (8 feet by 16 feet in the clear) is down 190 feet, and that it was expected to reach coal at 225 feet.

Webster County.—The Shamrock Coal Co. opened a shaft mine in No. 9 coal, near Providence. See "Notes on the Mines."

Whitley County.—The Cockill Coal Co. opened a mine near Williamsburg, making its first shipment in November. See "Notes on the Mines."

The Main Jellico Mountain Coal Co. opened a mine in the "Blue Gem" seam, at Kensee, which it is working longwall. The operations are fully described by Mr. Hywel Davies in his paper, prepared for this report.

ABANDONED OR SUSPENDED.

Bell County.—The Tuckehoe mine was closed down. In a receiver's hands.

Butler County.—The old West Aberdeen mine was about exhausted at the close of the year.

The Aberdeen mine, B. Baker, Lessee, suspended at the close of the year.

Johnson County.—The Greasy Creek mine was temporarily closed down July 18th. See "Notes on the Mines."

Knox County.—The Blue Gem mine, which was operated by the Knox Gem Coal Co. (now defunct) for part of 1901, was idle in

1902, except at occasional times when two or three men would get out a little coal for local use.

Laurel County.—The Kentucky mine, near Altamont, which was in operation in 1901, was suspended in 1902.

The Victoria mine, which was operated for a part of 1901, was idle throughout 1902.

G. W. Currin's old mine, in operation in 1901, was abandoned and a new opening made. See "Notes on the Mines."

Muhlenberg County.—The Mud River mine, which was in operation in 1901, was idle throughout 1902. A fire occurred December 17, 1901, destroying the tipple, engine room and machinery. A new opening was started, and there was some promise of rebuilding the tipple and resuming shipments in 1902, but this was not done.

Pulaski County.—The old Cogar Creek mine was shut down July 1st and remained idle thereafter. See the Nixon mine, in "Notes on the Mines."

The old Indian Creek mine was abandoned early in the year. See Indian Head mine, in "Notes on the Mines."

Rockcastle County.—The Pine Hill mine, which was in operation until November 1, 1901, was idle during 1902.

IV.

GENERAL CONDITION OF THE MINES.

Excepting the investigation of an accident which occurred in the Central Coal & Iron Co.'s Central mine on February 15th, the field work for 1902 began March 4th, about six weeks after the present officials took charge, the time intervening between January 20th (when their predecessors retired) and that date being occupied with necessary office work.

As stated in the letter of transmittal, a severe injury received by the writer prevented him from making his due share of the inspections, but the work has at all times been under his direct supervision. Between the Chief Inspector and the Assistant there have been constant conferences and perfect accord with respect to all matters pertaining to the latter's work. This statement is made in view of the fact that in some quarters an impression seemed to exist that, in some way, the office was divided in matters of administration—that a sort of independence of movements obtained, which could not result otherwise than in confusion and impairment of the efficiency of the office. The writer has endeavored to conduct the work in business-like fashion, and to that end the Assistant was instructed that nothing should be done in a merely perfunctory way; that no merely so-called "inspections" should be made simply to save appearances in the matter of complying with the requirement as to the number of times a mine should be inspected during the year. It is believed that it will be generally admitted that these instructions have been faithfully followed.

A very large number of the mines, if not the larger number of them, were, as the work of inspection proceeded, found

to be in a deplorably bad condition. In some cases this was especially surprising, since the list included mines which were known to have in former years been maintained in fairly good to excellent condition. Specifications on this point will be found in the detailed reports relating to individual mines. To what extent such defective conditions may be attributed chiefly to deterioration between the date of last inspection and that upon which inspections under the present administration were made, or to what extent they may have been due to the change of personnel of the office (assuming a possible supposition on the part of managers that a relaxation of vigilance would follow the change), the writer is not prepared to say.

But, while stating the facts plainly as regards the defective state of so many of the mines, the writer recognizes that it would be neither correct nor proper to omit saying, at the same time, that there were a number of gratifying exceptions. These, also, will be noted in the reports on the individual mines.

By the end of the year, as may be gleaned from the brief notes given from the inspection notices that were served, a marked improvement in the condition of the mines in general had been wrought. It is believed that this pleasing fact is quite generally acknowledged by those employed underground. As a rule, defects were remedied with a fair degree of promptitude. In some cases, however, there was a dilatoriness that was cured only by impending presentments for indictment; and in two instances it was necessary to report recalcitrant operators to the Commonwealth's Attorneys. The New Diamond Coal Co., of Laurel county, was reported to Hon. J. L. Isaacs, Commonwealth's Attorney for the Fifth District; and the Paris Coal Co., of Pulaski county, was reported to Hon. J. N. Sharp, Commonwealth's Attorney for the Third District.

FATALITIES FOR 1901.

During the year 1901 there were 21 fatal accidents, 19 of which occurred underground. The causes were:

Fall of Top	5
Mining Standing Shot	2
Drilling out Missed Shot	2
Returned on Shot	1
Filling Cartridge	1
Mine Cars	2
Riding Trip	3
Timbering	1
In Shaft; Hoisting Rope Broke	2
Total Inside	19
Run Over by Loaded Gondola, Outside	1
Boiler Explosion, Outside	1
Total	21

The tonnage raised and the persons employed inside per inside death were as follows:

Tonnage raised per inside death	280,248
Employes inside per inside death	438
Tonnage raised per total deaths, in and out	253,558
Persons employed per total deaths	466
Deaths inside per each 1,000 employes inside	2.2828
Total deaths per each 1,000 employes	1.911

These figures, compared with those for 1900, show an increase of two in the number of inside deaths and a decrease of 15,086 tons in the amount of coal raised per inside fatality. It is difficult to determine from the published report for 1900 just what was the average number of persons employed inside during that year, but so well as can be made out upon the basis used in the report (85 per cent. of the total), the deaths per 1,000 persons inside (2.2828) were 0.3063 greater than in 1900.

In view of a comparison made in the 1900 report of the writer's predecessor (whose administration also covered the year 1901) be-

tween fatalities in 1900 and in 1891 (the writer having been at the head of this office during the latter year), it is deemed no more than proper to here correct an impression that might have been made by such comparison. It is said in the report referred to (17 inside fatalities having occurred in 1900):

“For example, I maintain that the loss of ten men in the production of 2,000,000 tons of coal is more fatal than the loss of twenty men in the production of 5,000,000 tons, and if this be true, then the 17 deaths and the output of 5,020,675 tons during 1900 is a far better record than was made in 1891, with its 16 deaths and output of only 2,950,136 tons.”

If there was any lesson to be taught by a comparison of fatality statistics for the year 1900, when the work of inspection was divided between two men, with those for 1891, when there was only one man to attend to all the duties of the office, then the comparison should have been made on the proper basis—*i. e.*, inside deaths should have been compared with inside deaths. Three of the 16 fatalities of 1891 occurred outside, thus leaving 13 deaths to be compared with the 17 inside fatalities of 1900. The coal raised per inside death in 1891 amounted to 226,933 tons (not to only 184,383, as might be supposed from the statement quoted), which was 69,401 less than in 1900, and 53,255 tons less than in 1901—not an unfavorable comparison for 1891, all things being considered.* It may be remarked, however, that no attempt was made to gloss over the high death-rate of 1891. It was recognized that with the increase in the number of mines and in the output of individual mines, the work of the office had so grown that it was beyond the physical ability of one man to properly look after all the mines, hence an assistant was asked for. Subsequent to the appointment of an assistant, the tonnage annually raised per death was increased. The present necessity for an additional assistant has already been set forth.

* In the report for 1900 the year 1899 is referred to as “the banner year of the office” with respect to tonnage raised per death. As shown on a succeeding page, this was a mistake. The “banner year” was 1896. The year 1898 was the banner one during my predecessor’s administration.—C. J. N.

FATALITIES FOR 1902.

A somewhat more favorable report may be made for 1902 than for the previous year, but the accident rate is still too large, notwithstanding the greatly increased tonnage raised, since there were 19 fatalities, 18 of which occurred underground. It may be said, however, that four of the deaths underground were practically suicides. Three men returned to their working places, which were known to have very little ventilation, almost immediately after firing heavy shots, despite warnings not to do so, and they were asphyxiated by the powder fumes. One man, passing up an entry with a car, noticed a place in the entry where he could get a load of "easy" coal, the pillars at that point being so affected by weight that coal had been slabbed off. The top was dangerous to work under, and the driver accompanying the man urged him not to undertake to load the coal under such conditions. He persisted, however, and was killed by a side fall.

Following is a list of the fatalities in 1902, with the causes stated:

Fall of Top	11
Fall of Side	1
Premature Blast	1
Powder Explosion	1
Hit by Trap Door	1
Returned on Powder Smoke, asphyxiated	3
Inside	18
Riding Trip, Outside	1
Total Deaths	19

The tonnage raised and the persons employed inside per inside death were as follows:

Tonnage raised per inside death	357,189
Employes inside per inside death	543
Tonnage raised per death, in and out	338,390
Persons employed per death, in and out	633
Deaths inside per each 1,000 employes inside	1.826
Total deaths per each 1,000 total employes	1.578

The feature of the fatality list which calls for most grave consideration is the number of deaths from falls of top. The figures for 1901, with respect to this question, compared with those for 1900 seemed encouraging at the time they were made up, but those for 1902, notwithstanding that the tonnage raised per death from all causes was nearly 85,000 greater than in 1901, are quite otherwise. The plain truth is that the increase in number of deaths from roof falls during the last three years is disturbing, and it calls for most serious consideration on the part of all persons concerned with the mines. It is a waste of time to indulge in fine distinctions as to responsibility. The point is that men are being killed, and many more injured, by falls of top, at a rate that the ordinary risks of coal mining, with our tonnage, do not justify, and the thing to do is for every mine manager to take up the question and make earnest, vigorous efforts to lessen the dangers from bad roof. With one exception the deaths from falling roof occurred in the Eastern field, seven of them in the Southeastern District, and three of them in the Northeastern. It is feared that the tonnage and expense question has too often been allowed to obscure the safety question. In some instances the physical conditions, as a whole, noted in the mines where such accidents occurred suggest faulty methods of mining—a system of mining out wide spaces, robbing everything back to the entry stump, using few props, and yet leaving but little in the way of stump or pillar along the entries a system which had gone on so long, unchecked, that there was a general tendency throughout the mine for falls to occur. In some of the mines, also, it was noted that not only were pillars allowed to be too thin, but too little regard was paid to keeping the rooms promptly and sufficiently propped. Another evil combination noted was thin room-pillars and staggered break-throughs. And still another evil noticed—one which inevitably weakens the roof throughout the workings and causes patches of rock or slate to fall here and there—was lack of parallelism in the courses of the rooms on one and the same range, resulting in rooms

cutting into each other here and diverging there, thus leaving thick and thin blocks of coal scattered about higgledy-piggledy fashion. Roof falls will occur most unexpectedly and despite the most careful management, but the danger can be materially reduced by making the excavations in a regular, systematic way, maintaining adequate pillars and keeping up regular lines of props. There are too many mines where sufficient attention is not paid to this matter—where mine maps are regarded rather as nuisances that must be gotten up once a year for the Mine Inspector, than as plans to be consulted frequently in pushing the workings ahead at the mine. Some years ago, referring to a state of affairs similar to that found existing in 1902, the present writer said:

“Observation shows that the failure to prop is by no means to be laid entirely to the charge of the ‘careless’ miner. When the roof along entries, for the condition of which the miner is in nowise responsible, is not kept in good order, but, on the contrary, is allowed to go unscaled or untimbered up to the ‘last moment,’ long after dangerous conditions have appeared, a looseness of management is indicated which militates against the validity of the explanation ‘carelessness of the miner,’ so often given for accidents which have occurred in the rooms. The difficulties in the way of enforcing mine rules are not underestimated, but the writer believes that wise rules and more diligent attention to the condition of the roof on the part of mine officials would materially reduce the percentage of casualties due to falls of top. A system of examination, by a mine official or special inspector, of the roof in rooms opened in those parts of the mine where ‘bad top’ has been encountered, before the miners enter in the morning, would certainly give good results.”

No one understands better than the writer the absolute necessity for economizing in coal mining, but there is no economy in occurrences of falling roof in working places—certainly none when injuries to men result—and it is earnestly urged that this very serious question be given more vigilant attention than seems

to have been the case at some of the mines. There may be no hope for the miner who persists in taking chances, such as delaying to reset knocked-out props, or delaying to set posts within proper time after his coal has been shot down, but the number of injuries due to such recklessness is really inconsiderable when compared with the total, and a persistent, vigorous campaign against "bad top" (which will include a scientific, systematic method of mining) should certainly reduce the percentage of deaths due to falls of roof.

The relation between the use of machines for mining and injuries from falls of top has not yet been satisfactorily determined. The writer will suggest, however, that when deciding between air and electric machines, the character of roof and its liability to fall should always be given serious consideration. It is beyond question that in some mines the character of the roof absolutely prohibits the use of electric machines, if the safety of men is to be regarded.

A study of the statistics of fatalities in Kentucky mines since the creation of the position of Assistant Inspector is of interest. The figures are as follows, in periods of five years each:

For Five Years, Ending January 1, 1897.

Years	Total Product	Inside Deaths	Tons Raised per Inside Death	Deaths per 1,000 Employees Inside
1892	3,027,298	5	605,459	0.6548
1893	3,302,250	11	300,204	1.1862
1894	2,957,195	9	328,577	0.9735
1895	3,207,770	7	458,253	0.7777
1896	3,183,992	5	636,696	0.5075
	15,677,992	37	2,329,189	.....

Average tonnage raised per inside death per year. 463,838.

Tonnage raised per inside death for whole period, 423,730.

Inside deaths per 1,000 employes inside for whole period, 0.8223.

For Five Years, Ending January 1, 1902.

Years	Total Product	Inside Deaths	Tons Raised per Inside Deaths	Deaths per 1,000 Employes Inside
1897.....	3,304,053	12 ^a	275,338	1.7762 (?)
1898.....	3,542,132	6	590,355	0.8396 (?)
1899.....	4,505,439	8 ^b	563,179	0.9752 (?)
1900.....	5,020,675	17	295,334	1.9565 (?)
1901.....	5,324,712	19	280,248	2.2828
	21,697,011	62	2,004,454	.....

Average tonnage raised per inside death per year, 400,891.

Tonnage raised per inside death for whole period, 343,500.

Inside deaths per 1,000 persons inside for whole period, 1.5624.

(Note: Statistics for employes from 1897 up to 1901 are given in such form that it is difficult to determine just what was the number of persons employed inside from 1897 to 1900 inclusive. The writer has used the basis given in the reports for the years in question, namely, 85 per cent. of the maximum number of persons reported for December each year.)

a. In the published report for this year, the number of deaths inside is put at 11, and tonnage computations made accordingly. A fatal accident in a shaft was counted as outside, an erroneous classification which was not repeated in subsequent years.

b. Two inside fatalities were not considered in the computation of tonnage raised per death in the published report for this year, because the victims were not on the company rolls. One death was that of a boy who was assisting his father and brother—killed by powder explosion, which occurred while he was filling a cartridge can. The other was that of a young man (killed by fall of coal) who was temporarily assisting a friend. To omit such deaths from the fatality statistics simply because the persons killed were not on company rolls is erroneous. Presumably they were occupied in the mines by consent of the foremen. The fact that they were not on the rolls doubtless absolves the company from responsibility in damage suits; but that is all. The day has been, if it is not now, when many lads were employed in mines by their fathers without "the office" having account of them; and when two diggers would at times be working together and the roll show only one—though this is unusual.

Figures for the first year (1902) of the third five-year period have already been given, showing:

Tonnage raised per inside death	357,189
Inside deaths per 1,000 persons inside	1.826

The following table shows the number of inside fatalities, and the causes, since provision was made requiring such statistics to be returned to this office:

Fatalities for 15 Years.

CAUSES	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	Total
Fall of Top	9	9	8	10	4	9	6	4	4	5	3	4	12	5	11	101
Fall of Coal			1	1						1	1	2	1			7
Fall of Side															1	1
Premature Blast		1								1	1	1			1	5
Returned on Blast		1												1		2
Missed Shot	1		2			1			1							5
Mg. Standing Shot														4		4
Blown Through Shot							1									1
Powder Explosion	3											1	1		1	6
Gas and Dust Explos'n										2						2
Filling Cartridge														1		1
Mine Cars				2			1	1		1			1	5		12
Motor										1						1
Mg. Machine											1					1
In Slope								2								2
In Shaft					1	1				1			2	2		7
Timbering														1		1
Trap Door															1	1
Powder Fumes		1					1								3	5
Totals	14	12	9	13	5	11	9	7	5	12	6	8	17	19	18	165

The total output of the mines for the fifteen years represented in the foregoing table amounted to 53,917,234 tons, in the getting of which 165 lives were sacrificed underground. The coal raised per death inside for the whole period amounted to 326,771 tons.

The following table shows the number of tons raised per death from fall of top, and the percentage of deaths due to roof falls for the past fifteen years.

Relating to Roof Falls for 15 Years.

Year	Deaths from Fall of Top	Tons Raised per Death from Top Falls	Percentage of Deaths Due to Falls
1888	9	264,988	64.3
1889	9	239,584	75.0
1890	6	422,042	66.6
1891	10	295,013	76.1
1892	4	756,824	80.0
1893	9	366,916	81.8
1894	6	492,866	66.6
1895	4	801,942	57.1
1896	4	795,869	80.0
1897	5	660,810	41.7
1898	3	1,180,710	50.0
1899	4	1,126,359	44.4
1900	12	418,389	70.6
1901	5	1,064,942	26.3
1902	11	584,492	64.7

If the whole number of years be divided into periods of five years each it is found that there has been, on the whole, a progressive decrease in the percentages of death due to falls of top, so that the figures for the first three years of the third term were conspicuously low; and that were it not for the high percentages of 1900 and 1902 the decrease in the third term would be most encouraging. The average percentages for each term are as follows: From 1888 to 1892 inclusive, 72.4. From 1893 to 1897 inclusive, 65.4. From 1898 to 1902 inclusive, 51.2 per cent. The first five years covered by the administration of the writer's immediate predecessor (1897 to 1901 inclusive), were especially fortunate ones, the average percentage of deaths due to top falls having

been only 46.6. Percentages, however, are of little value in reaching a verdict as to the care paid to the roof; the total number of deaths from falls must be considered, and as stated on a preceding page, these have increased since 1899 at such rate as to demand sharp attention.

SAFETY CAGES.

The tendency on the part of some mine managers seems to be to go to one extreme or another as regards safety-catches—either to deem them of no value at all, and therefore not worth looking after constantly, or to place entirely too much faith in them and in their keeping in working order at all times. Safety-catches are not to be regarded as absolute guaranties of safety—they can not be counted upon to always stop the cage; but they unquestionably do contribute toward safety, and many fatal accidents have been averted by their use. The writer wishes to insist upon greater care being taken to keep them in good order than has been the case at some of the mines, and upon more frequent inspections of the hoisting rope. Among the reports received from one of the mines in 1901 is this: "Wire rope broke. Cage fell to bottom of shaft and was damaged so as to have to have a new cage. Mines idle five and a half days. No one hurt." It is wondered how long it had been before that accident that the rope was examined, and how often were the catches examined and tested.

INSPECTIONS MADE.

During the year 1901, according to the records of the office, 221 inspections were made, and 25 visits were paid without making examinations. These were divided between the Chief Inspector and Assistant as follows:

Year 1901.

	Inspection. tons.	Visits: No Examination.
By Mr. G. W. Stone, Chief	54	23
By Mr. C. W. Logan, Assistant	167	2
Total	221	25

These were distributed through the year as follows:

By Mr. G. W. Stone, 1901.

Month.	Inspections.	Visits: No Examinations.
February	1	..
May	14	1
June	3	2
August	5	..
September	18	1
October	7	..
November	6	..
December .....	..	14
Total	54	23
January, 1902	1	1

By Mr. C. W. Logan, 1901.

Month.	Inspections.	Visits: No Examinations.
January	1	..
February	12	1
March	13	..
April	20	..
May	25	1
June	17	..
August	12	..
September	28	..
October	11	..
November	20	..
Total	167	2

Summaries from the inspection notices and memoranda relating to visits indicated above are given in the "Notes on the Mines."

Year 1902.

During the year 1902 (as explained on a preceding page) practically all the inspections were made by the Assistant Inspector. There were 291 inspections, and 11 visits were made without making examinations. These were divided between the Chief Inspector and the Assistant as follows:

	Inspection. tons.	Visits: No Examination.
By C. J. Norwood, Chief	8	2
By A. G. Spillman, Assistant	283	9
Total	291	11

These were distributed through the year as follows:

By C. J. Norwood.

Month.	Inspections.	Visits: No Examination.
February	1	..
May	2	..
June	1	..
August	2	2
December	2	..
Total	8	2

By A. G. Spillman.

Month.	Inspections.	Visits: No Examinations.
March	30	..
April	14	1
May	35	3
June	24	1
July	30	..
August	25	..
September	34	..
October	35	1
November	27	1
December	29	2
Total	283	9

Summaries from the inspection notices are given for each mine in the "Notes on the Mines."

The inspections and visits in 1901 and in 1902 were distributed among the mines as follows:

MINE.	1901		1902	
	Inspections.	Visits: No Inspections.	Inspections.	Visits No Inspections.
BETLER COUNTY—				
Aberdeen	1	..	..	1
W. Aberdeen	2	..	1	..
BELL COUNTY—				
Pineville No. 1	4	..	3	..
" No. 2	4	..	3	..
Straight Creek No. 1	2	..	3	..
" No. 2	1	..	3	..
Bennett's Fork	2	..	3	..
Excelsior	2	..	1	..
Tuckehoe	2	..	Idle	1
Black Raven	1	..	3	..
Pineville No. 3 (1902) .....	..	..	3	..

MINE.	1901		1902	
	Inspection.	Visits: No Inspections.	Inspection.	Visits: No Inspections.
BOYD COUNTY—				
Rush No. 6	2	..	2	..
Rush No. 11 (1902) .....	..	..	2	..
Clinton No. 8	2	..	2	..
Princess	2	..	2	..
Winslow No. 1 (1902) .....	..	..	1	..
BREATHITT COUNTY—				
Jackson .....	..	2*	2	..
CARTER COUNTY—				
Ashland I. & M. No. 10	2	..	2	..
Boghead	2	..	2	..
Blair	2	..	Idle	..
Straight Creek	2	..	2	..
Lost Creek	1	1	2	..
Meadow Branch	2	..	2	..
Ashland I. & M. (Bailey, 1902) .....	..	..	1	..
CHRISTIAN COUNTY—				
Empire	2	1	2	..
DAVISS COUNTY—				
New Holland	3	..	..	2
Owensboro C. & M ¹ .....	..	..	1	1
HANCOCK COUNTY—				
Falcon	3	..	2	..
Auburn Ash (Op'd 1902) .....	..	..	1	..
HENDERSON COUNTY—				
Rankin	4	..	2	..
Baskett	3	..	2	..
Peoples'	2	..	2	1
Henderson	3	..	1	1
Corydon	2	1	1	1
HOPKINS COUNTY—				
Earlington No. 9	2	..	2	..
" No. 11	2	..	3	..
Hecla	2	..	2	..
Arnold	2	..	2	..
Barnsley	2	..	2	..
Diamond	2	..	2	..
St. Charles ("Old")	2	..	2	..
" ("New")	2	..	2	..
Oak Hill	2	..	2	..
Carbondale	3	..	1	1
Crabtree	2	..	2	..
Monarch (Victoria)	3	..	2	..
Reinecke	2	..	2	..
JOHNSON COUNTY—				
Whetstone	2	..	2	..
Greasy Creek	2	..	1	1

* Also a visit by G. W. S. in January, 1902.

MINE.	1901		1902	
	Inspections.	Visits: No Inspections.	Inspections.	Visits: No Inspections.
KNOX COUNTY—				
North Jellico No. 4	1	..	2	..
" No. 5	2	..	2	..
" (New) .....	..	..	2	..
" Wilton (1902) .....	..	..	2	..
East Jellico	2	..	2	..
Ross Jellico	2	..	2	..
Gray's	2	..	2	..
Artemus Jellico	1	..	2	..
Knox Gem	2	..	Idle	..
Hughes Jellico (1902) .....	..	..	3	..
LAUREL COUNTY—				
Laurel	1	..	3	..
Standard	2	..	4	..
Manchester	2	..	3	..
Lily	3	..	4	..
Pittman	1	..	3	..
Pittsburg No. 1	2	..	3	..
" No. 2 .....	..	..	2	..
New Diamond	2	..	4	..
Curvin's	2	..	2	..
Bastin & Pritchard	2	..	3	..
Flat Top (Altamont Co.) .....	..	..	4	..
Star Co. .....	..	..	3	..
LAWRENCE COUNTY—				
Peach Orchard (Annie)	2	..	2	..
" (Elizabeth)	1	..	2	..
LEE COUNTY—				
McGuire	2	..	2	..
White Ash (Norman)	1	1	2	..
MCLEAN COUNTY—				
Memphis Co.'s	2	..	3	..
Green River (1902) .....	..	..	3	..
MORGAN COUNTY—				
Kentucky Block .....	..	1	2	..
Caney etc.	1	4	2	..
MUHLENBERG COUNTY—				
Central	3	..	5	..
Powderly	3	..	3	..
Hillside	3	..	3	..
Oakland	3	1	3	..
Dovey	1	1	3	..
Luzerne	2	1	3	..
Crescent	2	1	3	..
Mud River	2	..	Idle	..
Pierce	2	..	3	..
Bevier	2	..	3	..

* Also a visit by G. W. S. in January, 1902.

MINE.	1901		1902	
	Inspection.	Visits: No In- spections.	Inspection.	Visits: No In- spections.
OHIO COUNTY—				
Render	5	..	4	..
Taylor	3	..	2	..
McHenry	3	..	2	..
Echols	2	1	3	..
Williams	3	..	3	..
Johnson	3	..	3	..
Deane field (Aetna)	3	..	3	..
" (Louise)	2	..	Idle	..
Jamestown (No. 1)	1	..	Idle	..
" (No. 2)	1	..	2	..
PULASKI COUNTY—				
Alpine	2	..	2	..
Barren Fork	2	..	2	..
Indian Creek	1	..	..	1
Paris	2	..	2	..
Cogar Creek .....	..	..	1	..
Cumberland .....	..	..	2	..
ROCKCASTLE COUNTY—				
Pine Hill .....	..	1	Idle	..
UNION COUNTY—				
Tradewater	2	..	4	..
Cumberland	2	..	3	..
DeKoven No. 9	2	..	3	..
Davidson's	2	..	3	..
American	2	..	3	..
WEBSTER COUNTY—				
Providence Slope	2	..	2	..
" Shaft .....	..	..	2	..
Sebree	2	1	2	..
Wheatcroft No. 1	1	1	2	..
" No. 2 .....	..	..	2	..
WHITLEY COUNTY—				
Vanderpool	2	1	3	..
Birdeye	1	1	..	2
Dowlals No. 1	2	1	3	..
" No. 2	1	1	3	..
Mountain Ash	2	1	3	..
Procter	2	1	3	..
Grinstead	2	1	3	..
Klondyke	2	..	2	..
Kensee	2	1	3	..
Mt. Morgan	2	..	3	..
Pine Knot	2	..	2	..
W. Jellico	2	..	2	..
Watts' Creek	New	1	3	..
Hoffman & Berry	New	1	3	..
Blue Gem (Kensee, 1902) .....	..	..	2	..
C. C. Cordell's (Tow Wad) .....	..	..	2	..

Summary.

	1901		1902	
	Inspection.	Visits : No Inspections.	Inspection.	Visits : No Inspections.
Bell	18	..	24	1
Boyd	6	..	9	..
Breathitt .....	..	2	2	..
Butler	3	..	1	1
Carter	11	1	11	..
Christian	2	1	2	..
Daviess	3	..	1	3
Hancock	3	..	3	..
Henderson	14	1	8	1
Hopkins	26	..	26	1
Johnson	4	..	3	1
Knox	12	..	19	..
Laurel	17	..	38	..
Lawrence	3	..	4	..
Lee	3	1	4	..
McLean	2	..	6	..
Morgan	1	1	4	..
Muhlenberg	23	4	29	..
Ohio	26	1	22	..
Pulaski	7	..	9	..
Rockcastle .....	..	1	Idle	..
Union	10	..	16	..
Webster	5	2	10	..
Whitley	22	10	40	..
Total	221	25	291	11

V.

STATISTICS FOR 1901.

No report having been issued for the year 1901, because of reasons that have already been given, statistics for that year, so far as the data furnished by the office records will permit, are here presented:

OUTPUT FOR CALENDAR YEAR 1901.

The total output of the commercial coal mines of the State for the calendar year 1901 amounted to 5,324,712 short tons, which was an increase of 304,037 tons over the product reported for 1900. The ton of 2,000 pounds is uniformly used throughout this statement. The output by districts was as follows:

OUTPUT BY DISTRICTS.

	Tons.
Western district	3,071,650
Southeastern district	1,680,875
Northeastern district	572,187
Total	5,324,712

Of the foregoing, 36,288 tons were of cannel, produced by the following districts:

	Tons.
Northeastern district	28,423
Southeastern district	7,865
Total	36,288

The output of cannel by counties for this year is given with the statements of cannel production for 1902, which see.

The net increased production in each district was as follows:

	Tons.
Western district	138,152
Southeastern district	76,445
Northeastern district	89,440
Total	304,037

GAINS AND LOSSES, 1901.

The gains and losses were distributed among the counties constituting each district as follows:

WESTERN DISTRICT—

	Gain.	Loss.
Butler .....	.....	13,025
Christian .....	.....	9,443
Daviess	6,492	.....
Hancock	765	.....
Henderson	28,894	.....
Hopkins .....	.....	5,039
McLean .....	.....	1,497
Muhlenberg	123,257	.....
Ohio .....	.....	30,996
Union	26,140	.....
Webster	12,604	.....
Totals	198,152	60,000
Net gain	138,152	

SOUTHEASTERN DISTRICT—

	Gain.	Loss.
Bell	108,133	.....
Knox .....	.....	20,412
Laurel .....	.....	29,837
Pulaski	31,926	.....
Whitley .....	.....	18,636
Totals	140,059	68,885

To the gain of 71,174 tons, add 5,271 for Rockcastle, from which county nothing was reported in 1900, and the net gain is 76,445 tons.

NORTHEASTERN DISTRICT—

	Gain.	Loss.
Boyd	17,273	.....
Breathitt	2,124	.....
Carter	44,032	.....
Johnson	23,400	.....
Lawrence .....	.....	2,563
Lee	1,547	.....
Totals	88,376	2,563

To the gain of 85,813, add 3,627 tons for Morgan county, not producing in 1900, and the net gain is 89,440 tons.

Output by Mines and Counties, 1901.

The output for the year 1901 reported by the respective coal companies was as follows, the mines being grouped according to counties and districts:

WESTERN DISTRICT—

	Tons.
Butler County—	
Aberdeen Coal and Mining Co.	8,650
West Aberdeen Coal Co.	9,113
Total	17,763
Christian County—	
Empire Coal and Mining Co.	73,220
Daviess County—	
New Holland Coal Co.	16,205
Owensboro Coal and Mineral Co.	1,159
Total	17,364
Hancock County—	
M. H. Enright, Falcon mine	6,634
Henderson County—	
Henderson Mg. and Mfg. Co.	10,587
People's Mining Co.	8,904
Arnold Coal Co.	65,174
Pittsburg Coal Co.	64,218
Corydon Coal Co.	7,714
Total	156,597
Hopkins County—	
Carbondale Coal Co.	29,489
Crabtree Coal Mining Co.	82,871
St. Bernard's Mining Co.'s:	
St. Charles mines	119,052
Diamond mine	119,269
Barnsley mine	85,786
Arnold mine	130,896
No. 9 Earlington mine	195,070
No. 11 Earlington mine	126,409
Hecla mine	97,305
Victoria Coal Co.	63,838
Reinecke Coal Mining Co.	253,838
Oak Hill Coal Co.	44,878
Total	1,348,701
McLean County—	
Memphis Coal Co.	29,819

Output by Mines and Counties, 1901—Continued.**WESTERN DISTRICT—Continued.****Muhlenberg County—**

	Tons.
Central C. & I. Co.'s Central mine	106,397
Central C. & I. Co.'s Powderly mine	44,043
Crescent Coal Co.	105,253
Bevier Coal Co.	69,920
Mud River Mining Co.	14,115
Black Diamond C. & M. Co.	61,302
Hillside Coal Co.	46,044
Oakland Coal Co.	38,332
Dovey Coal Co.	6,496
W. G. Duncan Coal Co.	40,936
Total	532,838

Ohio County—

Taylor Coal Co.	130,414
Central C. & I. Co.'s Render mine	101,810
McHenry Coal Co.'s McHenry mine	82,051
McHenry Coal Co.'s Echols mine	63,229
Williams Coal Co.	56,120
Deane field Coal Co.'s Aetna mine	28,050
Deane field Coal Co.'s Louise mine	24,377
Fordsville Block Coal Co.	11,391
Green River M., M., & T. Co.	7,262
Total	504,704

Union County—

Ohio Valley C. and M. Co.	79,897
Tradewater Coal Co.	101,309
Paducah C. M. Co.	71,529
Davidson & Sons	5,397
American C. and I. Co.	7,099
Total	265,231

Webster County—

Providence Coal Co.	58,976
Sebree Coal Co.	42,139
Wheatcroft C. and M. Co.	17,664
Total	118,779

SOUTHEASTERN DISTRICT—**Ball County—**

Bennett's Fork C. and C. Co.	18,582
Excelsior C. M. Co.	66,676
National C. and I. Co.	148,310
Pineville Coal Co.	70,176
Black Raven Coal Co.	6,580
Tuckehoe Coal Co.	2,763
Total	313,087

Output by Mines and Counties, 1901—Continued.**SOUTHEASTERN DISTRICT—Continued.**

Knox County—		Tons.
Knox Gem Coal Co.		3,974
East Jellico C. Co.		39,327
North Jellico C. Co. (Bertha)		192,393
North Jellico C. Co. (Wilton)		835
North Point Jellico C. Co.		24,254
Ross Jellico Coal Co.		30,503
Total		291,286
Laurel County—		
Bastin & Pritchard		31,199
G. W. Curvin		7,510
Manchester Coal Co.		36,315
Standard Coal Co.		27,184
New Diamond Coal Co.		54,964
Kentucky Coal Co.		2,658
Laurel Coal Co.		64,988
Pitman Coal Co.		36,469
Pittsburg Coal Co.		46,955
Lilly mine		13,996
Victoria Coal Co.		9,562
Total		331,800
Pulaski County—		
Paris Coal Co.		2,734
Joe C. Parker		12,624
Eagle Coal Co.		69,714
Cumberland Coal Co.		21,970
Alpine Coal Co.		27,296
Total		134,338
Rockcastle County—		
Pine Hill mine		5,271
Whitley County—		
East Tennessee Coal Co.		65,398
Main Jellico Mtn. C. Co.		109,153
Procter Coal Co. (Procter)		101,652
Procter Coal Co. (Grinstead)		75,603
J. W. Ratcliff		27,000
Whitley Coal Co.		22,768
Jellico C. M. Co.		65,562
Hoffman & Berry		680
Mt. Morgan Coal Co.		80,625
Watts Cr. Jellico C. Co.		3,250
West Jellico Coal Co.		10,875
Pine Knot Coal Co.		42,527
Total		605,093

Output by Mines and Counties, 1901—Continued.

NORTHEASTERN DISTRICT—

	Tons.
Boyd County —	
Ashland I. & M. Co. (Rush 6)	66,162
Ashland I. & M. Co. (No. 11)	7,238
Princess Land and Mining Co.	26,910
John Wurts (Clinton)	82,666
Total	182,976
Breathitt County—	
Jackson Coal Co.	18,540
Carter County—	
Adkins Coal Co.	6,822
Ashland I. and M. Co. (No. 10)	165,227
Strait Creek Coal Co.	51,535
E. K. Railway Co.	24,359
Ky. Cannel Co.	11,913
Total	259,856
Johnson County—	
Greasy Cr. C., C. and T. Co.	23,041
Whitehouse Cannel Co.	15,993
Total	39,034
Lawrence County—	
Peach Orchard Coal Co.	50,023
Torchlight Coal Co.	2,980
Total	53,003
Lee County—	
McGuire Coal Co.	7,190
L. C. Norman & Sons	7,961
Total	15,151
Morgan County—	
Caney Cannel Coal Co.	1,650
Ky. Block Cannel Coal Co.	1,977
Total	3,627

Output of Classes of Coal by Counties, 1901.

COUNTY.	Lump	Nut	Other Classes	Total.
Bell	36,130	1,618	275,339	313,087
Boyd	26,460	6,195	150,321	182,976
Breathitt	1,252	....	17,288	18,540
Butler	11,496	3,352	2,915	17,763
Carter	132,987	18,492	108,377	259,856
Christian	15,915	5,148	52,157	73,220
Daviess	9,942	662	6,760	17,364
Hancock .....	....	.....	6,634	6,634
Henderson	38,444	11,937	106,216	156,597
Hopkins	292,817	109,338	946,546	1,348,701
Johnson	35,983	1,698	1,353	39,034
Knox	169,187	7,407	114,692	291,286
Laurel	119,258	40,872	171,670	331,800
Lawrence	28,150	4,990	19,863	53,003
Lee	11,230	2,088	1,833	15,151
McLean	19,162	4,727	5,930	29,819
Muhlenberg	126,140	19,515	387,183	532,838
Morgan	3,067	....	560	3,627
Ohio	148,776	37,509	318,419	504,704
Pulaski	38,256	65,462	30,620	134,338
Rockcastle	1,780	2,096	1,395	5,271
Union	30,732	2,148	232,351	265,231
Webster	26,298	5,158	87,323	118,779
Whitley	173,183	101,297	330,613	605,093
Totals	1,496,644	451,710	3,376,358	5,324,712

The production of the various classes, given above, by districts was as follows:

District	Lump	Nut	Miscellaneous	Total
Western	719,721	199,495	2,152,434	3,071,650
Southeastern	537,794	218,752	924,329	1,680,875
Northeastern	239,129	33,463	299,595	572,187
Total	1,496,644	451,710	3,376,358	5,324,712

POWDER AND ANIMALS.

Under present circumstances it is impossible to ascertain the exact quantity of powder used at the mines. Some companies do not seem to keep more than a rough guess record of the amount used, and where diggers are employed (who furnish their ammunition themselves) it often happens that they buy more or less of their powder elsewhere than at the commissary, hence, except by means of a system which might be misconstrued by the miners as mere espionage, the companies are unable to make exact reports concerning the amount of powder consumed. It would appear from the figures reported that between 82,000 and 83,000 kegs (of 25 pounds) were consumed in 1901. The number of animals employed was between 1,350 and 1,400, of which perhaps 1,000 were used underground. The returns according to districts are as follows:

District	Powder, Kegs	Animals		
		In	Out	Total
Western	46,322	559	180	739
Southeastern	28,051	290	90	380
Northeastern	7,480	100	31	131
Total	81,853	949	301	1,350

PRODUCTION OF COAL ON RAILROADS.

A table is given in chapter VI. relating to statistics for the year 1902, which shows the production of the railroad mines in 1901.

PRODUCTION OF COKE.

Details concerning the production of coke, which in 1901 amounted to 97,763 tons, are given in connection with the coke statistics for 1902, in chapter VI.

NUMBER OF EMPLOYEES AND DAYS WORKED, 1901.

The greatest number of persons engaged at the mines in 1901 was 10,932. The average number was 9,783. Of these, 8,325 were employed underground. Notwithstanding the increase of output the number of persons employed has apparently remained about the same for several years. This may be due to the marked increase of machine mining without a corresponding increase of product. The number of persons employed and the average number of ten-hour days worked per mine, tabulated by counties, were as follows:

Counties	Greatest Number	Average Number	Engaged Under- ground	Average Days Worked
WESTERN DISTRICT—				
Butler	82	75	59	97
Christian	124	115	114	241
Daviess	53	51	41	140
Hancock	50	21	27	116
Henderson	312	292	242	220
Hopkins	1,795	1,763	1,478	241
McLean	53	51	49	152
Muhlenberg	1,010	931	866	134
Ohio	944	872	762	170
Union	464	395	301	172
Webster	209	209	162	194
Totals	5,096	4,775	4,101	171
SOUTHEASTERN DISTRICT—				
Bell	926	836	592	209
Knox	743	602	477	173
Laurel	1,010	833	764	173
Pulaski	341	301	253	186
Rockcastle	30	24	24	165
Whitley	1,352	1,207	1,080	176
Totals	4,401	3,803	3,190	180
NORTHEASTERN DISTRICT—				
Boyd	377	314	287	166
Breathitt	60	54	53	177
Carter	560	469	424	259
Johnson	161	137	94	252
Lawrence	105	93	81	219
Lee	77	58	50	187
Morgan	95	80	45	57
Totals	1,435	1,205	1,034	188

Summary.

District	Maximum Number	Average Number	Engaged Under- ground	Days per Estab- lishment
Western	5,096	4,775	4,101	171
Southeastern	4,401	3,803	3,190	180
Northeastern	1,435	1,205	1,034	188
Totals	10,932	9,783	8,325	185

DISPOSITION OF PRODUCT AND VALUE, 1901.

No statistics as to disposition of the product of the mines and its value were collected by the writer's predecessor, hence there are no data of such sort in the records of the office relating to 1901. The table below is taken from the report on the production of coal by Mr. E. W. Parker, issued by the U. S. Geological Survey.* A comparison of the table with figures already given will reveal differences between the output returns stated for individual counties by the Federal Survey, and those gathered by this office, although the figures given for total production by both offices are near together—the total output of commercial coal reported by this office being 4,726 tons greater than the total (with "small mines" out) reported by the Federal Survey. In some counties the Federal Survey reports a larger production than that which is reported by this office, which may be accounted for by the fact that this office deals only with commercial mines and with those that employ more than five persons underground, while the Survey undertakes to report all coal; in other counties the Survey's figures are less than those given by this office, which may, possibly, be explained by failures of some of the producers to make reports to the Survey, or by the fact that some of the mines were not in operation all the year. The figures presented by this office for the 1901 output of commercial coal may be accepted with confidence; the totals are made up from monthly reports, which are required by law, and when the writer entered upon his duties in January, 1902, he was at pains to check up the office records and get complete returns from all commercial producers who were operating in 1901. With this explanation, no misunderstanding need occur with respect to the U. S. Geological Survey figures, which (omitting the 150,000 tons estimated for "small mines") are as follows:

* "Mineral Resources of the United States, Calendar Year 1901."—U. S. Geological Survey, Washington, D. C.

REPORT OF INSPECTOR OF MINES.

COUNTY	Loaded at mines for shipment <i>Short Tons</i>	Sold to local trade and used by employees <i>Short Tons</i>	Used at mines for steam and heat <i>Short Tons</i>	Made into coke <i>Short Tons</i>	Total production <i>Short Tons</i>	Total value	Average price per ton	Average number of days active	Average number of employees
Bell	257,765	5,430	3,850	66,200	333,235	\$ 336,874	\$1.01	205	1,113
Boyd	172,030	680	1,220	.....	173,930	138,902	.80	282	381
Butler	14,950	3,842	.....	.....	18,802	16,851	.90	95	80
Carter	23,335	8,972	3,119	.....	246,526	314,020	1.28	239	468
Henderson	139,849	27,133	2,383	.....	169,305	156,314	.92	218	383
Hopkins	1,216,132	24,093	31,435	90,639	1,362,299	1,069,258	.78	254	1,818
Johnson and Morgan	36,782	710	200	.....	37,692	57,897	1.54	301	383
Knox	277,003	2,260	4,443	.....	283,706	282,530	1.00	226	487
Laurel	310,986	2,296	2,416	.....	315,698	282,642	.90	198	781
Lawrence	36,449	2,615	7,860	.....	46,924	48,861	1.04	236	95
McLean	17,226	340	150	.....	17,716	13,983	.79	79	77
Muhlenberg	520,067	6,277	6,192	304	532,840	472,868	.88	176	957
Ohio	493,787	5,347	3,840	.....	502,974	445,832	.89	197	801
Pulaski	123,348	7,710	2,729	.....	133,787	168,764	1.22	222	326
Rockcastle	12,000	3,000	.....	.....	15,000	15,000	1.00	250	30
Union	251,283	14,045	7,376	4,134	277,337	251,629	.91	195	470
Webster	113,261	3,092	5,763	.....	122,116	103,834	.85	220	334
Whitley	581,622	5,494	3,952	.....	591,068	725,515	1.23	195	1,362
Breathitt and Lee	37,126	200	.....	.....	37,326	44,682	1.20	205	93
Christian, Davless, and Hancock*	96,705	420	520	.....	97,645	79,543	.81	238	181
Totals	4,947,716	123,046	87,947	161,277	5,319,986	\$5,025,576	.943	213	10,307

*For Davless and Hancock combined the average price per ton was 96.73 cents. For Hopkins and Christian combined the price was 78.65 cents per ton.

According to districts, the average selling values at the mines shown by the above table were as follows:

DISTRICTS	Tons Total Product	Total Value	Average Value per Ton
Western	3,101,094	\$2,609,899	\$0.8416
Southeastern	1,677,494	1,811,315	1.0796
Northeastern	541,398	604,362	1.1163
Total	5,469,986	\$5,025,576	\$0.9427

It should be remembered that this table does not agree, as regards output, with returns gathered by this office.

The differences in regard to the production of individual counties, between the returns reported by this office and those given in the table above, are as follows, the figures being plus or minus with respect to the Survey returns as compared with those collected by this office:

COUNTIES	U. S. G. S. reports in excess of amounts reported by this office	U. S. G. S. reports less than amounts reported by this office
Bell	20,148	.....
Boyd .....	.....	9,046
Butler	1,039	.....
Carter .....	.....	14,330
Henderson	12,768	.....
Hopkins	13,598	.....
Johnson and Morgan .....	.....	4,969
Knox .....	.....	7,580
Laurel .....	.....	16,102
Lawrence .....	.....	6,079
McLean .....	.....	12,103
Muhlenberg	2	.....
Ohio .....	.....	1,730
Pulaski	4,449	.....
Rockcastle	9,729	.....
Union	12,106	.....
Webster	3,337	.....
Wrightley .....	.....	14,025
Breathitt and Lee	3,635	.....
Christian, Daviess and Hancock	427	.....
Totals	81,238	85,904
Net difference .....	.....	4,726

a.—It is possible that the Survey's report for Rockcastle county (15,000 tons) was an estimate.

VI.

STATISTICS FOR 1902.

The output of the commercial coal mines of Kentucky for the calendar year 1902 amounted to 6,429,419 short tons, which was an increase of 1,104,707 tons over the production of 1901. This is the greatest output, and the largest increase within a single year, in the history of the State. Although we may be disposed to congratulate ourselves on this showing, it does not in fact indicate such progress in the production of coal in Kentucky as should be the case. Notwithstanding the abundance, the great excellence and the uniquely favorable location of our coal beds with reference to use for industrial establishments, and notwithstanding our wealth of mineral things upon which to found and sustain such establishments, we have been eighteen years in increasing our coal output from 1,550,000 tons (1884) to somewhat less than 6,500,000 in 1902.

The indications now are, however, that we are to steadily forge ahead, and if the exhibit to be made at the St. Louis World's Fair by the Kentucky Exhibit Association shall prove as successful in presenting the advantages for the establishment of manufacturing enterprises in the State as it is believed will be the case, we may look for a very great expansion of our coal mining industry within the next few years.

The course of production since the creation of the office of Inspector of Mines has been as follows:

COURSE OF PRODUCTION.

Beginning with 1,550,000 tons in 1884, we were four years in attaining an output of 2,384,893 tons, an average gain of 208,723 tons per year.

To reach 3,027,297 tons required four years (1888 to 1892), an average gain of 160,601 tons per year.

To reach 4,505,439 tons required seven years (1892 to 1899), an average gain of 211,163 tons per year.

To reach 5,020,675 tons required one year (1899 to 1900), a gain of 515,243 tons.

To reach 6,429,419 tons required, two years (1900 to 1902), an average gain of 704,372 tons per year.

Having in mind the general industrial history of the country since 1887, it seems well to present the rate of progress of Kentucky coal mining during the last fifteen years, according to periods of five years each:

1887-'92—A gain of 1,094,112 tons. An average gain of 218,822 tons per year.

1892-'97—A gain of 276,756 tons. An average gain of 55,351 tons per year.

1897-'02—A gain of 3,125,366 tons. An average gain of 625,073 tons per year.

OUTPUT BY DISTRICTS, 1902.

The output for 1902, according to districts, was as follows:

	Tons.
Western district	3,644,315
Southeastern district	2,040,200
Northeastern district	744,904
	<hr/>
Total	6,429,419

The net increased production in each district was as follows:

	Tons.
Western district	572,665
Southeastern district	359,325
Northeastern district	172,717
	<hr/>
Total	1,104,707

GAINS AND LOSSES, 1902.

The gains and losses by counties, compared with the output for 1901, were as follows:

WESTERN DISTRICT—

	Gain.	Loss.
Butler .....	.....	7,657
Christian	13,233	....
Daviess .....	.....	7,927
Hancock	4,821	....
Henderson .....	.....	10,040
Hopkins	197,158	....
McLean	35,354	....
Muhlenberg	196,172	....
Ohio	16,955	....
Union	36,972	....
Webster	97,624	....
Totals	598,289	25,624
Net gain	572,665	

SOUTHEASTERN DISTRICT—

	Gain.	Loss.
Bell	66,842	....
Knox	174,700	....
Laurel	52,780	....
Pulaski	31,345	....
Rockcastle .....	.....	5,271
Whitley	38,929	....
Totals	364,596	5,271
Net gain	359,325	

NORTHEASTERN DISTRICT—

	Gain.
Boyd	66,755
Breathitt	6,825
Carter	25,223
Johnson	20,372
Lawrence	1,295
Lee	15,195
Morgan	37,052
Total gain	172,717

CLASSES OF COAL REPORTED, 1902.

DISTRICT	Tons Lump	Tons Nut	Tons all other classes	Tons Total
Western	731,572	200,011	2,712,732	3,644,315
Southeastern	650,803	221,563	1,167,834	2,040,200
Northeastern	105,015	11,694	628,195	744,904
Totals	1,487,390	433,268	4,508,761	6,429,419

For the classes reported by each county see under the respective counties in chapter X., "Notes on the Mines."

OUTPUT BY COUNTIES, 1902.

The output for the year 1902 reported by the respective coal companies, arranged by counties, and with address of head office, was as follow:

WESTERN DISTRICT—**Butler County—**

	Tons.
B. Baker, lessee (Aberdeen)	2,925
West Aberdeen C. Co. (Morgantown)	7,180
Total	10,105

Christian County—

Empire C. & M. Co. (Empire)	86,453
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Davless County—

New Holland C. Co. (Owensboro)	8,541
Owensboro C. & M. Co. (Owensboro)	896
Total	9,437

Hancock County—

M. H. Enright (Adair)	6,365
Auburn Ash C. Co. (Cloverport)	5,091
Total	11,456

WESTERN DISTRICT—**Henderson County—**

	Tons.
Henderson M. & M. Co. (Henderson)	12,161
Arnold C. Co. (Spottsville)	56,685
People's M. Co. (Henderson)	8,755
Pittsburg C. Co. (Baskett)	61,907
Corydon C. Co. (Corydon)	7,049

Total 146,557

Hopkins County—

Carbondale C. & C. Co. (Hamby Station)	38,965
Crabtree C. M. Co. (Ilsley)	97,475
Nortonville C. Co. (Nortonville)	75
Oak Hill C. Co. (Nortonville)	67,117
Reinecke C. M. Co. (Madisonville)	272,006
St. Bernard M. Co.'s:	
Arnold	146,489
Barnsley	81,940
Diamond	137,471
Hecla	115,935
No. 11	147,747
No. 9	202,440
St. Charles	134,624
Victoria C. Co. (Madisonville)	103,575

Total 1,545,859

McLean County—

Memphis C. Co. (Island)	46,896
Green River C. Co. (Island)	17,937

Total 64,833

Muhlenberg County—

Black Diamond C. & M. Co. (Drakesboro)	72,770
Bevier C. Co. (Cleaton)	97,620
Central C. & I. Co.'s:	
Central	137,454
Powderly	41,289
Crescent C. Co. (Bevier)	151,408
Dovey C. Co. (Greenville)	42,618
Hillside C. Co. (Greenville)	48,030
W. G. Duncan C. Co. (Luzerne)	94,849
Oakland C. Co. (Greenville)	42,549
S. J. Gish	423

Total 729,010

Ohio County—

Taylor C. Co. (Louisville)	144,611
Williams C. Co. (Louisville)	72,122
Deaneffeld C. Co. (Aetnaville)	50,716
Fordsville B. C. Co. (Fordsville)	9,675
Green River M. M. & T. Co. (Coffman)	12,642
McHenry C. Co.'s:	
McHenry	61,598
Echols	63,787
Central C. & I. Co. (Render)	106,508

Total 521,659

WESTERN DISTRICT—Continued.

Union County—	Tons.
Davidson & Sons (Uniontown)	6,853
American C. & I. Co. (Uniontown)	18,035
Ohio Valley C. & M. Co. (DeKoven)	94,404
Tradewater C. Co. (Sturgis)	102,274
Paducah C. M. Co. (Sturgis)	80,637
Total	302,203

Webster County—

Providence C. Co. (Providence)	94,914
Sebree C. Co. (Sebree)	78,936
Wheatcroft C. & M. Co. (Wheatcroft)	41,654
Shamrock C. Co. (Providence)	899
Total	216,403

SOUTHEASTERN DISTRICT—**Bell County—**

Pineville C. Co. (Pineville)	78,268
Black Raven C. Co. (Fourmile)	42,419
Excelsior C. Co. (Excelsior)	49,044
National C. and I. Co. (Straight Creek)	188,094
Tuckehoe C. Co. (Fourmile)	1,905
Bennett's Fork C. and C. Co. (Middlesboro)	20,199
Total	379,929

Knox County—

Ross Jellico C. Co. (Artemus)	35,720
North Point Jellico C. Co. (Grays)	19,044
North Jellico C. Co.'s:	
Bertha	209,144
Wilton	100,749
East Jellico C. Co. (Coalport)	56,097
Artemus Jellico C. Co. (Artemus)	20,465
Hughes Jellico C. Co. (Flatlick)	24,767
Total	465,986

Laurel County—

Pittsburg C. Co. (Pittsburg)	60,152
Bastin C. Co. (East Bernstadt) ..	22,418
New Diamond C. Co. (Altamont)	67,427
Pitman C. Co. (Pittsburg)	57,169
Laurel C. Co. (Pittsburg)	29,486
Standard C. Co. (Viva)	52,055
G. W. Curvin (Viva)	10,235
Manchester C. Co. (East Bernstadt)	38,264
Altamont C. Co. (Altamont)	12,398
Star C. Co. (East Bernstadt)	23,120
Leota C. and C. Co. (Lily)	11,856
Total	384,580

SOUTHEASTERN DISTRICT—Continued.**Pulaski County—**

	Tons.
Eagle C. Co. (Barren Fork)	71,996
Alpine C. Co. (Alpine)	39,371
New Cumb. C. Co. (McGuffey)	35,388
Indian Head C. Co. (Parker Lake)	4,713
Joe C. Parker (Parker Lake)	2,000
Paris C. Co. (Parker Lake)	6,890
Cogar Creek C. Co. (Flatrock)	4,485
Nixon C. Co. (Flatrock)	840
Total	165,683

Whitley County—

Jellico C. M. Co. (Mt. Ash)	56,151
E. Tennessee C. Co. (Jellico)	67,975
Mt. Morgan C. Co. (Williamsburg)	56,265
Main Jellico Mt. C. Co. (Kensee)	116,160
Hoffman & Berry (Williamsburg)	22,782
Whitley C. Co. (Halsey)	7,708
Louisville Property Co. (Halsey)	8,528
Procter C. Co. (Red Ash)	166,101
Watts Cr. Jellico C. Co. (Wofford)	19,941
West Jellico C. Co. (Strunk)	39,140
Pine Knot C. Co. (Strunk)	71,763
J. W. Ratcliffe (Red Ash)	8,734
C. C. Cordell & Co. (Pine Knot)	1,683
Cockill C. Co. (Williamsburg)	591
Total	644,022

NORTHEASTERN DISTRICT—**Boyd County:**

Ashland I. and M. Co. (Ashland)	100,011
Princess L. and M. Co. (Princess)	41,206
John Wurts, lessee (Ashland)	108,514
Total	249,731

Breathitt County—

Jackson C. Co. (Jackson)	4,716
R. T. Davis (Jackson)	470
Kentucky Union Co. (Jackson)	20,179
Total	25,365

Carter County—

E. K. Ry. Co. (Riverton)	39,441
Strait Cr. C. Co. (Mt. Sterling)	38,935
Adkins C. Co. (Mt. Sterling)	9,745
Kentucky Cannel Co. (Riverton)	13,314
Ashland I. and M. Co. (Ashland)	183,643
Total	285,079

NORTHEASTERN DISTRICT—Continued.

Johnson County—	Tons.
Whitehouse C. C. Co. (Louisa)	53,511
Greasy Cr. C. C. Co. (Eliza)	5,081
Sandy River C. Co. (Eliza)	815
Total	59,407
Lawrence County—	
Peach Orchard C. Co. (Peach Orchard)	50,512
Torchlight C. Co. (Louisa)	1,786
Total	54,298
Lee County—	
L. C. Norman & Sons (Lexington)	21,569
McGuire C. Co. (Beattyville)	8,777
Total	30,346
Morgan County—	
Caney C. C. Co. (Biggstaff)	2,475
Biggstaff C. C. Co. (Biggstaff)	11,204
Ky. Block C. C. Co. (Cannel City)	27,000
Total	40,679

DISPOSITION OF THE PRODUCT, 1902.

The output in tons of the several districts was disposed of as follows:

DISTRICT	Loaded at Mines for Shipment	Sold to Local Trade and Employees	Coked	Used for Steam and Heat at Mines	Total Product
Western	3,359,402	84,084	115,466	85,363	3,644,315
Southeastern	1,895,043	19,539	96,096	29,522	2,040,200
Northeastern	674,418	3,814	53,084	13,588	744,904
Totals	5,928,863	107,437	264,646	128,473	6,429,419

TONNAGE SHIPPED TO OTHER STATES, 1902.

Only 58 per cent. of the total product of our mines is used in the State, and only 54 per cent. of the tonnage shipped from the mines is sent to points within Kentucky. The following table shows the tonnages shipped to other States from the several districts:

DISTRICT	Total Product	Tons Shipped to Outside Points	Per cent. of Product Shipped Out
Western	3,644,315	2,089,762	57.34
Southeastern	2,040,200	525,395	25.75
Northeastern	744,904	100,473	13.49
Totals	6,429,419	2,715,630	42.24

Omitting the coal that is consumed at and near the mines (for steam, for ventilation and for local trade) and that converted into coke at the mines, and dealing only with the tonnage shipped from the mines, it is found that the percentages of the shipments which go to other States are as follows:

DISTRICT	Tons Shipped from the Mines	Tons to Other States	Percentage to Other States
Western	3,359,402	2,089,762	62.26
Southeastern	1,895,043	525,395	27.62
Northeastern	674,418	100,473	14.90
Totals	5,928,863	2,715,630	45.83

HOME CONSUMPTION, 1902.

A smaller percentage of the output was consumed at home in 1902 than was the case six years ago, when (in 1896) only about 33 per cent of the total production was shipped to other States.* The actual tonnage called for by Kentucky consumers has advanced from 2,146,392 tons in 1896 to 3,713,789 in 1902, the home consumption during the past year being 530,311 tons greater than was the total output for the State six years ago, the increase since 1896 being at the rate of 261,233 tons per year. Although this showing is encouraging, and is much better than that for the four years preceding 1896—during which period there was little change in the home consumption from year to year—it is not such a showing as, in view of the wonderful strides that have marked the industrial development of the country within recent years, the State should have been able to make, and could make were our natural resources sufficiently well known and appreciated.†

If Kentucky is to win an adequate share of the general prosperity of the country, and derive in full measure the profit stored in the great wealth with which nature has endowed this part of the earth, then it is necessary that enterprises shall be established which will call for a greater expansion of our coal-mining industry on account of the State's necessities alone. An increase of our outward shipments of coal is desirable, so long as it does not result from untoward conditions within the State itself, as from undue competition in our home markets with coal from other States; but it is far more desirable as it is far more profitable, that we shall have more manufacturing and industrial plants; that we shall utilize to a larger degree than is now done those of our

*The office records afford no definite data as to tonnages shipped out of the State between the years 1896 and 1902.

†The use of natural gas does not explain relatively small proportion of our production that is consumed at home. In 1901 the value of gas produced was \$270,871, of which \$187,660 was marketed in the State—displacing \$143,011 of fuel in Kentucky, which at the average value for coal (94.27 cents) would mean the displacement of only 151,704 tons of Kentucky coal in the home market.

raw products to which some attention is already given, and that industries shall be established upon those that are now practically neglected.

Following is a statement of the home consumption of the production of our mines for such years as statistics upon which it could be determined were gathered:

Home Consumption of Kentucky Product.

YEAR	Western District	Southeastern District	Northeastern District	Total Tons
1892	1,039,515	671,347	361,385	2,072,247
1893	1,259,196	926,470	354,575	2,540,241
1894	1,110,825	614,247	231,745	1,958,817
1895	1,120,683	791,294	349,050	2,261,027
1896	1,000,776	846,524	299,092	2,146,392
1902	1,554,553	1,514,805	644,431	3,713,789

SELLING VALUE OF PRODUCT, 1902.

As stated on a preceding page, there are no definite data among the records of this office as to the selling value of the commercial output for 1901, hence comparisons can not satisfactorily be made between figures for 1902 and for 1901. The best that can be done is to compare the statistics as to selling price gathered by this office for 1902 with those gathered by the U. S. Geological Survey for 1901, and since the Survey statistics are not restricted to the same class of mines that alone is dealt with by this office, it is evident that comparisons under such circumstances can yield only approximate results. Judging from the trade conditions of the past year, it was presumed that figures for the selling price for 1902 would show a material gain over 1901, but comparisons made

as indicated above show a gain of only 1.56 cents per ton, the total product being considered. The Western District shows a gain of 3.95 cents, and the Southeastern shows a gain of 4.78 cents, but the Northeastern District shows a loss of 10.85 cents per ton. The writer, having no knowledge of conditions in the Northeastern District in 1901, can offer no intelligent suggestion as to why the selling price in that district fell off in 1902.

The selling value, on board at the mines, according to districts, for 1902 was as follows:

Selling Value, 1902.

DISTRICT	Tons Total Product	Total Value	Average per Ton
Western	3,644,315	\$3,174,882.56	\$0.8711
Southeastern	2,040,200	2,300,231.76	1.1274
Northeastern	744,904	750,524.91	a1.0075
Totals	6,429,419	\$6,225,639.23	b\$0.9683

a.—Selling value of straight bituminous was, \$0.9157.

b.—Selling value of straight bituminous was, \$0.9580.

The writer is aware of the fact that it would be more instructive to present statistics as to the selling prices at the mines according to counties, as is done by the U. S. Geological Survey, but when gathering the statistics for 1902 the guaranty was given that results would only be made public as related to districts. It is hoped that hereafter the coal operators will be willing that this office shall publish its statistics in regard to selling values in the same form as that adopted by the Federal Survey—*i. e.*, by counties, any county in which there is only one mine being combined with some other county in the same field, in order that privacy as to individual prices may be preserved.

The writer returns his thanks to the operators for the prompt

and frank way in which they responded to his request for confidential information. Only nine operators, representing a total tonnage of less than 391,000 tons, failed to comply with his requests. It is hoped that hereafter replies will be received from all.

PRODUCTION OF COAL ON RAILROADS.

The following table shows the production of coal on the several lines of railroad in the State:

RAILROADS	Tons, 1901	Tons, 1902
LOUISVILLE & NASHVILLE R. R.:		
Henderson & Nashville Division	1,241,552	1,448,939
Providence Division	58,976	95,813
Owensboro & Nashville Division ...	386,806	524,085
Knoxville Division	942,164	916,016
Cumberland Valley Division	604,373	845,915
Total	3,233,871	3,830,768
ILLINOIS CENTRAL R. R.:		
Main Line	840,887	989,448
Ohio Valley Division & Connections.	290,609	350,906
Owensboro Division	63,818	60,391
Total	1,195,314	1,400,745
Louisville, Henderson & St. Louis ...	162,818	150,750
Chesapeake & Ohio & Connections	534,869	648,515
Lexington & Eastern & Connections.	37,318	96,390
Cincinnati Southern	187,740	278,269

PRODUCTION OF CANNEL.

The tonnages of cannel produced during the calendar years 1901 and 1902, respectively, and included in the total output reported for each year, were as follows:

Short Tons.

COUNTIES	1901	1902
Bell	7,348.68	6,293.57
Carter	11,203.31	11,339.98
Johnson	14,153.00	15,171.68
Morgan	3,067.00	32,353.61
Whitley	515.90	1,898.13
Total	36,287.89	67,056.97

The cannel reported for 1902 was produced by the following companies:

In Bell County:	Tons.
Pineville Coal Co.	6,293.57
In Carter County:	
Kentucky Cannel Co.	11,339.98
In Johnson County:	
Greasy Creek C., C. & T. Co. and Sandy River C. Co.	3,473.70
Whitehouse C. C. Co.	358.00
In Morgan County:	
Caney Creek C. C. Co. and Biggstaff C. C. Co.	7,671.00
Ky. Block C. C. Co.	24,353.61
In Whitley County:	
Whitley Coal Co. and Louisville Property Co.	1,898.13

PROGRESS IN COAL PRODUCTION.

The progress in the production of commercial by Kentucky mines during the last twenty-three years has been as follows:

YEAR	Bituminous	Cannel	Total
1880 .....	.....	.....	914,000
1884 .....	.....	.....	1,550,000
1888	2,342,058	42,835	2,384,893
1889	2,205,434	40,285	2,246,259
1890	2,483,144	49,382	2,532,526
1891	2,907,096	43,040	2,950,136
1892	2,973,455	53,842	3,027,297
1893	3,258,712	42,538	3,302,250
1894	2,899,692	57,503	2,957,195
1895	3,128,023	69,747	3,207,770
1896	3,128,818	54,660	3,183,478
1897	3,247,542	56,511	3,304,053
1898	3,492,243	49,889	3,542,132
1899	4,469,100	36,389	4,505,439
1900	4,991,205	29,470	5,020,675
1901	5,288,424	36,288	5,324,712
1902	6,362,362	67,057	6,429,419

The increase from 1880 to 1890 was 172 per cent; from 1890 to 1902, inclusive, it was 153 per cent.

During the last ten years, divided into five-year periods, the increases have been: 1892 to 1897, inclusive, an increase of 9 per cent.; 1897 to 1902, inclusive, an increase of 94 per cent.

The output of the Western District alone in 1902 was greater than the total product of the entire State for 1898 or for any

preceding year. In 1884 (when the office of Inspector of Mines was created) the output of the Southeastern District amounted to 384,031 tons—only about 4,000 tons greater than the output of Bell county alone in 1902. In 1902 the product of the district exceeded that of the entire State for 1884, and it came within less than 492,000 tons of equaling the output of the State for 1890.

The aggregate output for the last fifteen years amounted to nearly 54,000,000 tons:

	Tons.
1888 to 1898	29,094,857
1898 to 1903	24,822,377
Total	53,917,234

It will be observed that the output for the last five years is only about four and a half million tons less than for the preceding ten years. In other words, more than 46 per cent. of the aggregate output for the past fifteen years was produced in the last five years.

PRODUCTION OF COKE.

The growth in the production of coke within recent years has been marked, but the total tonnage is small when compared with what may confidently be expected, as the development of the coking fields of Pike county and contiguous regions, now under way, progresses. The tonnage produced in 1902 exceeded that made in 1901 by 28,796 tons, and product for the latter year exceeded that for 1900 by 11,862 tons.

The production for the calendar years 1901 and 1902, respectively, was as follows, in net tons:

Output for 1901 and 1902.

COUNTY	Company	1901	1902
Bell	National C. & I. Co.	24,359	38,746.75
"	Pineville Coal Co.	8,061	13,082.50
Boyd	Ashland I. & M. Co.	23,320	23,075.00
Hopkins ...	St. Bernard Mining Co. .	40,083.30	48,938.00
Union	Ohio Valley C. & M. Co. .	1,939.50	2,717.20
Totals ..	.....	97,762.80	126,559.45

The production according to districts was:

	1901.	1902.
Western District	42,022.80	51,655.20
Southeastern District	32,420.00	51,829.25
Northeastern District	23,320.00	23,075.00
Total	97,762.80	126,559.45

In the reports of this office for 1898, 1899 and 1900 the production of the Northeastern District (Boyd county) is not given. It was as follows for each of the years named:

	Tons.
For 1898	809
" 1899	11,430
" 1900	12,926

NUMBER OF OVENS.

All ovens are of the bee-hive type. The number at each plant in the State is as follows:

Company.	Ovens.
National C. & I. Co., Bell County	200
Pineville Coal Co., Bell County	50
Ashland Iron & Mining Co., Boyd County	66
St. Bernard Mining Co., Hopkins County	156*
Ohio Valley Coal & Mining Co., Union County	20†
Wheatcroft Coal & Mining Co., Webster County	3‡
Total	495

Coke-making in Kentucky (not taking into consideration "city ovens," which are only for the purpose of utilizing the fine coal produced in the rehandling of shipments of fuel coal received, when the fines can not well be disposed of otherwise) dates from 1887, in which year 4,000 tons were produced in the Western field. In 1889 the first coke made in the Eastern field was produced at the Pineville Coal & Coke Co.'s ovens (now owned by the National Coal & Iron Co., in Bell county,) the output amounting to 1,892 tons. From that year down to 1898 the curve of production (including both coal fields) has been quite irregular, rising to its maximum in 1893 (46,148 tons), falling to 25,459 tons in 1895, rising to 32,265 tons in 1897, and in 1898 falling to its lowest point (21,393 tons) since 1890. The undulations between the years indicated were chiefly due to the erratic performances marking production in the Eastern field—the line for that field dropping from 11,334 tons in 1893 to zero in 1894, for instance; rising to 7,392 tons in 1896, then dropping to 841 tons in 1898, and as swiftly rising to 31,209 tons in 1899.

Since 1898, in which year the Northeastern District came in for the first time (with the ovens of the Ashland Iron & Mining Co., in Boyd county) as a producer of coke, the production of each field has climbed steadily upward, the increase being especially marked in the Eastern field, the output of the older ovens in the Southeastern District having for the first time, in 1902, exceeded that of the Western field. The annual output, in short tons, for the past five years has been as follows:

*Of these 21 were built in 1902.

†Of these 10 were completed in 1903.

‡These were completed in 1903. No coke was made by this company in 1902.

YEAR	Western District	Southeastern District	Northeastern District	Total
1898	21,361	32	809	22,202
1899	35,801	19,797	11,480	55,580
1900	36,864	36,111	12,926	72,975
1901	42,023	32,420	23,320	97,763
1902	51,655	51,829	23,075	126,559

The product of the Ashland Iron & Mining Co.'s ovens is consumed by that company at its iron and steel furnaces at Ashland. The coke made in the Western field is shipped principally to lead smelters and to "domestic" consumers; it is a most excellent substitute for anthracite. That produced by the Bell county ovens is shipped principally to copper smelters and to iron furnaces in the South.

Progress is making toward the establishment of ovens in the Pike county region, but because of delays in railroad construction, it is not probable that any ovens will be built in that field before 1904.

NUMBER OF EMPLOYES AND DAYS WORKED, 1902.

The average number of persons engaged at and in the mines during the past year was 12,036, of which 9,867 were employed underground. The greatest number employed during any one month was 12,673, during the month of December. Referring to the average number, they were distributed among the three mining districts as follows:

DISTRICT	Inside	Outside	Total
Western	4,537	940	5,477
Southeastern	3,733	876	4,609
Northeastern	1,597	353	1,950
Total	9,867	2,169	12,036

The following table shows the number of persons employed in the various counties, together with the average number of ten-hour days worked, per distinct mining operation, in each county:

COUNTY	Inside	Outside	Total	Days
WESTERN DISTRICT—				
Butler	26	11	37	102
Christian	147	4	151	247
Daviess	27	5	32	90
Hancock	48	19	67	118
Henderson	209	72	281	215
Hopkins	1,575	318	1,893	259
McLean	97	13	110	159
Muhlenberg	939	158	1,097	154
Ohio	820	156	976	159
Union	358	111	469	183
Webster	291	73	364	240
Total	4,537	940	5,477	

COUNTY	Inside	Outside	Total	Days
SOUTHEASTERN DISTRICT—				
Bell	700	229	999	224
Knox	644	273	917	234
Laurel	723	170	893	220
Pulaski	338	148	486	177
Whitley	1,328	286	1,614	211
Total	3,733	876	4,609	
NORTHEASTERN DISTRICT—				
Boyd	462	46	508	240
Breathitt	93	17	110	257
Carter	559	113	672	242
Johnson	223	88	311	196
Lawrence	88	35	123	191
Lee	76	23	99	230
Morgan	96	28	127	231
Total	1,597	353	1,950	

POWDER AND ANIMALS, 1902.

As explained under this head in the statistical report for 1901, chapter V., the returns relating to consumption of powder at the mines are only approximately correct. The indications are that about 110,000 or more kegs were used. The number of animals employed was probably about 1,400. Following are the aggregates of returns received from each district:

DISTRICTS	Powder, Kegs	Animals		
		In	Out	Total
Western	53,977	622	141	763
Southeastern	34,904	339	95	434
Northeastern	10,732	135	23	158
Total	109,613	1,096	259	1,355

MACHINE MINED COAL, 1902.

Mining machines are used by 31 companies in 40 mines, the aggregate number of machines being 349. Of these, 302 were in use in 1902; 16 were installed near the close of 1902, but cut no coal in that year; one, a longwall machine, was idle (mine filled with water and suspended); and 30 were installed subsequent to January, 1903.

The coal produced by machine amounted to 2,932,382 tons, being 45.60 per cent. of the total commercial product.

According to districts, the machine-mined coal was as follows:

DISTRICT	Tons Cut by Air	Tons Cut by Electricity	Total Tons by Machine	Per cent. Total Prod. Cut by Machine	Per cent. Mach. Coal Cut by Air	Per cent. Mach. Coal Cut by Elec.
Western	1,153,453	1,190,439	2,343,892	64.31	49.21	50.78
Southeastern	387,225	143,047	530,272	25.99	73.02	26.97
Northeastern	58,218	.....	58,218	7.81	100.00	.....
Total	1,598,896	1,333,486	2,932,382	45.60	54.52	45.47

The amounts of machine coal produced by counties were as follows:

COUNTY	Machines Cutting in 1902	Tons Cut by Air	Tons Cut by Electricity	Total Tons Cut by Machine	Total Prod. Cut by Machine
WESTERN DISTRICT—					
Christian	7	.....	86,453	86,453	100 -
Hopkins	93	850,712	548,171	1,398,883	90 -
Muhlenberg	15	.....	266,860	266,860	36 -
Ohio	34	144,611	219,573	364,184	69 -
Union	24	158,130	.....	158,130	52 -
Webster	5	.....	69,382	69,382	32 -
Total	178	1,153,453	1,190,439	2,343,892	64 -
SOUTHEASTERN DISTRICT—					
Bell	9	.....	42,298	42,298	10 -
Knox	51	251,217	100,749	351,966	75 -
Laurel	8	65,484	.....	65,484	14 -
Whitley	28	70,524	.....	70,524	10 -
Total	96	387,225	143,047	530,272	25 -
NORTHEASTERN DISTRICT—					
Boyd and Carter	10	29,705	.....	29,705	5 -
Breathitt	7	20,179	.....	20,179	79 -
Lawrence	11	8,334	.....	8,334	15 -
Total	28	58,218	.....	58,218	7 -

COMPANIES USING MACHINES.

Following are the companies using mining machines, some of them having installed their machine plant about the close of 1902, or since January 1, 1903:

Bell County.—Pineville Coal Co., Wallsend; electric. Black Raven Coal Co., Fourmile; electric. Tuckehoe Coal Co., Fourmile; has an electric longwall machine, but company has been in a receiver's hands most of the year, and the mine in which the machine was placed has been flooded all the year.

Boyd County.—Ashland Iron & Mining Co., Ashland; air.

Breathitt County.—Kentucky Union Co., Jackson; air.

Christian County.—Empire Coal & Mining Co., Empire; electric.

Hopkins County.—Crabtree Coal Mining Co., Ilsley; air. Oak Hill Coal Co., Nortonville; electric. Reinicke Coal Mining Co., Madisonville; electric. Victoria Coal Co., Madisonville; electric. St. Bernard Mining Co., Earlington; air and electric.

Knox County.—East Jellico Coal Co., Coalport; air. North Jellico Coal Co., Bertha and Wilton (head office, Louisville); air and electric.

Laurel County.—New Diamond Coal Co., Altamont; air. Standard Coal Co., Viva; air.

Lawrence County.—Peach Orchard Coal Co., Peach Orchard; air. Torchlight Coal Co., Louisa; air.

Morgan County.—Kentucky, Block Cannel Coal Co., Cannel City; air.

Muhlenberg County.—Black Diamond Coal Co., Drakesboro; electric. Crescent Coal Co., Bevier; electric. W. G. Duncan, Luzerne; electric. S. J. Gish, Central City; air.

Ohio County.—Taylor Coal Co., Taylor Mines (head office, Louisville); air. McHenry Coal Co., McHenry and Echols; electric. Central Coal & Iron Co., Render (principal offices, Central City and Louisville); electric.

Union County.—Tradewater Coal Co., Sturgis; air. Ohio Valley Coal & Mining Co., DeKoven; air.

Webster County.—Providence Coal Co., Providence; electric.

Whitley County.—Jellico Coal Mining Co., Mountain Ash; air. Mt. Morgan Coal Co., Williamsburg; air.

The following table shows the number of the various types of machines used:

TYPES OF MACHINES USED.

AIR		ELECTRIC	
Type	Number	Type	Number
Harrison Pick	167	Morgan-Gardner Chain .	25
Sullivan Pick	29	Jeffrey Chain	36
Ingersoll-Sergeant Pick ...	58	Link-Belt and Goodman Chain	29
Jeffrey-Legg Chain	4	Jeffrey Longwall	1
Total	258	Total	91

The machines are distributed according to Districts as follows:

DISTRIBUTION OF MACHINES.

DISTRICT	Com- panies Using	Num- ber of Mines	Num- ber of Ma- chines	Power	
				Air	Elec.
Western	17	25	198	132	66
Southeastern	9	10	105	81	24
Northeastern	5	5	46	46	..
Total	31	40	349	259	90

VII.

WAGE SCALES.

Following are the wage scales which are in force in the organized districts of the State. With respect to the Western field (known in agreements, between scale committees as the "Central Kentucky District"), the agreement of 1902 is also given, in order that the existing one of April 1, 1903, may be compared with it. Except as to minimum, outside wage, which was advanced from \$1.28 as in 1900 and 1901 to \$1.42 in 1902 (together with some additional provisions in Resolution 15, which are indicated at the proper place), the scale of 1902 was practically the same as that for 1901 and 1900, and the latter was an advance of 13 2-3 per cent. over all prices for 1899.* The scale for 1903 is an advance of 10 per cent. over that for 1902, pick mining going to 82½ cents per ton, with all other prices advanced equally.

CENTRAL KENTUCKY DISTRICT, 1902.

Central City, Ky., April 30, 1902.

The members of the Western Kentucky Coal Operators Association, and Miners of the Western Kentucky Coal Field, in joint session, hereby adopt as the agreement for the ensuing year ending March 31, 1903, the following:

Pick Mining.

RESOLUTION NO. I.

Resolved, That the price of pick mining for the year ending March 31, 1903, shall be 75 cents per ton over the District Standard Screen (twelve feet long, five feet wide, one and one-half inch

*The price for pick mining, for example, was advanced in 1900 from 66 cents per ton (as in 1899) to 75 cents per ton, and thus maintained until April 1, 1903.

space between bars, five-eighths inch face). It is distinctly understood that when any company uses a shaker screen that screens more than a standard screen, they shall weigh coal in the cars on a run of mine basis. It is agreed that the ratio of lump coal to mine run over one and one-half inch district standard screen shall be based on 62 per cent. going into the weigh box, and this per cent. shall regulate the ratio of lump and run of mine coal whenever any change is made in the price of mining.

That the mine run price shall be forty-six and one-half cents per ton, an equivalent of 62 per cent. of 75 cents per ton, the price of lump coal.

It is understood that coal shall be mined two and one-half feet, and the solid may be shot not more than an equal amount, except at Spottsville, New Holland, Baskett and Henderson, where miners shall mine coal as much as possible.

It is understood that the above prices apply to all veins that have been recognized as No. 9, or its equivalent.

RESOLUTION NO. 2.

Resolved, That the price of yardage in entries shall be \$1.14 per yard, but when the entry exceeds ten feet, and is not more than twelve feet, the price shall be 85 cents per yard, and no yardage shall be paid in excess of twelve feet.

All break-throughs driven entry width shall be paid for at entry prices. Should the bank boss and the man driving an entry agree that it is wet, then the miner shall receive twenty-eight and one-fourth cents per yard extra.

RESOLUTION NO 3.

Resolved, That the price of turning rooms shall be \$3.40 per room.

Machine Mining.**RESOLUTION NO. 4.**

Resolved, That the price for drilling, shooting, loading and timbering after chain and punch machines shall be one-half the price of pick mining, the companies using the chain machines to pay such additional price per ton for bradding the coal, handling the slack, and taking up the bottom, as can be agreed upon by the mines affected, or have it done by the day.

RESOLUTION NO. 5.

Resolved, That the chain machine runners and helpers shall be paid at the rate of \$4.25 per twenty-seven cuts, under ordinary conditions, divided \$2.25 to the runner and \$2.00 to the helper, and when they work by the day, the runner shall receive twenty-eight and one-fourth cents per hour, and the helper twenty-five cents per hour.

It is understood that fourteen square feet shall constitute a cut for the five-foot machine, and seventeen square feet shall constitute a cut for the six-foot machine.

Resolved, That punch machine runners shall receive twenty-eight and one-fourth cents per hour, and the helper shall receive twenty-one and one-fourth cents per hour, when they work by the hour. Ten and three-fourths cents per ton of screen coal to cutter, six and a fourth cents per ton of screen coal to helper; or 1.14 cents per square foot to the cutter, and .0068 to the helper.

RESOLUTION NO. 6.

Resolved, That the yardage for chain and punch machines shall be fifty-seven cents per yard for three runs, and forty-two and one-half cents per yard for four runs, to be divided as follows: Forty cents to the loader, nine cents to the cutter, and eight cents to the helper in chain machine mines when three runs are made; and in the same proportion when four runs are made.

Punch machine mines shall pay thirty cents to the loader, sixteen cents to the cutter, and eleven cents to the helper when the entry is less than ten feet; and in the same proportion when the entry is twelve feet.

No yardage shall be paid by either machine company when the work is done by the day, nor when entries are more than four runs wide.

RESOLUTION NO. 7.

Resolved, That turning rooms in machine mines shall be paid for by the yard, as per Resolution No. 6, divided between loaders, helpers, and cutters, when not working by the day.

RESOLUTION NO. 8.

Resolved, That where a man or a man and a boy are loading after a machine, and not claiming more than a turn and a half, they shall be entitled to two rooms where practical.

RESOLUTION NO. 9.

Resolved, That the companies shall lay all roads and timber all bad places not caused by the miners' own negligence.

RESOLUTION NO. 10.

Resolved, That a square turn shall be kept all over the mines in rooms and narrow work under ordinary conditions. Half turn to boys between fourteen and sixteen years of age.

RESOLUTION NO. 11.

Resolved, That miners absent from their working places for three consecutive days, shall forfeit their working places, and any day man absenting himself without reasonable excuse shall forfeit his working place.

RESOLUTION NO. 12.

Resolved, That any miner loading an unusual amount of slate, sulphur or other impurities, shall be laid off one day for each offense. The weigh-master and check-weighman to be the judges of such unusual amounts; and any miner laid off for three days during any one month shall then be subject to discharge.

RESOLUTION NO. 13.

Resolved, That check-weighman shall have a number to run his account, and shall be allowed to cut each miner for his own wages, and for all dues and assessments of the U. M. W. of A., provided that in the case of dues and assessments each employe shall give a written order authorizing the employer to make such cuts. Similar cuts for day men shall be collected on the same condition through the office.

RESOLUTION NO. 14.

Resolved, That no mass-meeting shall be held during working hours, on or off the company's premises, when the mine is running, and any one calling a meeting shall be subject to discharge.

No committee shall visit any employe at his working place, except in company with the bank boss, to settle a grievance; and any employe caught out of his working place during working hours, except for satisfactory reasons, is liable to have his turn stopped, at the option of the bank boss.

RESOLUTION NO. 15.

Resolved, That all labor shall be paid for by the hour, or quarters of hours, and that eight hours shall constitute a day's labor, so far as mine laborers and miners are concerned; but the eight hours shall not affect the engineers, firemen, pumpers, outside teamsters, night-watchmen, blacksmiths, or special repair work, or such men as are now paid by the month.

That an eight-hour day means eight hours' work in the mines

at usual working places for all classes of day labor and miners, and any miner late, without reasonable excuse, shall forfeit his turn for the day. This shall be exclusive of the time required in reaching working places and departing from same at night.

Regarding drivers, they shall take their mules to and from the stable, and the time in so doing shall not include any part of the day's work, their work beginning when they reach the change at which they receive the empty cars; but in no case shall a driver's time be docked while he is waiting for such cars at point named.

It is distinctly understood that the time of starting the run each day depends on the arrival of railroad cars, and that the eight-hours run shall be counted from the time of starting, provided the run begins within two hours from the regular starting time.

It is also understood that miners and day men will respond promptly to the starting time, and that no shooting shall be done until nine hours after the starting time, subject to the penalties of Resolution No. 18, as hereafter provided.

The following scale of wages shall be paid for inside work:

	Per Day.
Track layers	\$2 00
'Track-layers' helpers	1 82
Trappers	57
Bottom cagers	1 82
Drivers	1 82
Riders	1 82
Water haulers	1 82
Timbermen	2 00
Pipemen	1 92
All other inside day labor	1 82
The minimum outside scale of wages for work about the mine shall be.	1 42

[In emergencies, and in the absence of any regular employe, the right of the operator to employ men not members of the U. M. W. of A. for outside day labor shall not be questioned. The men so employed as temporary employes shall not work more than three

days at any one time without becoming members of the U. M. W. of A.

The initiation fee for admission to and qualification for membership in this District of the U. M. W. of A. shall not be in excess of \$5.00 for outside men.

The local conditions existing at each mine in respect to the rate of wage paid to men when taken from one kind of employment to another to fill temporary vacancies, shall not be disturbed.

Drivers, while handling more than one mule, gathering from working places, or more than two mules hauling on entries, shall receive in excess of the regular wage of \$1.82 per day, two cents per hour for each extra mule in excess of the number respectively mentioned above.]*

That there shall be no boys employed as drivers, except on straight track, and said drivers shall receive twenty-five cents per day less than the District scale.

RESOLUTION NO. 16.

Resolved, That the price of blacksmithing at pick mines shall be 134-100 cents per \$1.00 earned by each miner, and at machine mines blacksmithing shall be 67-100 cents per \$1.00 earned by each miner.

RESOLUTION NO. 17.

Resolved, All employes affected by this agreement shall be paid on the first Saturday after the tenth of each month for the labor performed during the latter half of the preceding calendar month, and on the 28th of each month for labor performed during the first half of the current month. This second payment, as provided above, shall be in the nature of a cash advance in even dollars.

*The four paragraphs of Resolution 15 inclosed in brackets are additional to the agreement of 1901.

RESOLUTION NO. 18.

Resolved, That employes are liable to be discharged for:

- (a.) Disorderly conduct.
- (b.) Gambling and shooting on the company's premises.
- (c.) Taking coal, tools, timber, etc., without permission.
- (d.) Firing before the run stops without permission of the bank boss.
- (e.) Committing a nuisance in entries, air-ways, or necks of rooms.

RESOLUTION NO. 19.

Resolved. That in the event of an instantaneous death by accident in or around the mine, the miners and underground employes shall have the privilege of discontinuing work for the remainder of that day, but work, at the option of the operator, shall be resumed the day following, and continue thereafter. In case the operator decides to operate the mine on the day of the funeral of the deceased, individual employes may, at their option, absent themselves from work for the purpose of attending such funeral, but not otherwise. And in the event that the operator shall elect to operate the mine on the day of such funeral, then, from the proceeds of such day's operation, each person employed at the mine at which the deceased member was employed, shall contribute fifty cents and the operator \$25.00 for the benefit of the family of the deceased or his legal representatives, to be collected through the office of the company. Except in the case of fatal accidents, as above, the mine shall in no case be thrown idle because of any death or funeral, but in the case of the death of any employe of the company or member of his family, any individual miner may, at his option, absent himself from work for the sake of attending such funeral, but not otherwise.

RESOLUTION NO. 20.

Resolved, That married men shall at all times form the majority of all committees.

RESOLUTION NO. 21.

Resolved, That in all conferences, the employes of each mine, or especially the mine affected, shall be represented by not less than three employes of such mine, and that the voting power shall always be vested in such employes, but this does not preclude the presence of any officials of the labor organization.

RESOLUTION NO. 22.

It is agreed that if any difference arises between the operator and the miners at any mine, a settlement shall be arrived at without stopping work. If the parties immediately affected can not reach an agreement between themselves, the question shall be referred, without delay, to a board of arbitration consisting of two members, one to be the Commissioner, or a similarly designated official, selected by the operators, or his appointee, the other the President of District No. 23, United Mine Workers of America, or his appointee. In the event of these two being unable to reach a decision, they shall select a third member, and the decision of said Board of Arbitration shall be final and binding on all parties to this agreement, and those they represent. But under no circumstances shall work stop before the decision of the Board of Arbitration is received, and such stoppage of work, before the decision of the Board of Arbitration is received, shall be sufficient cause to discharge the Mine Committee and the party or parties causing the dispute, unless the committee show they have used due diligence to keep the men at work.

RESOLUTION NO. 23.

Resolved, The operator and his superintendent and mine manager shall be respected in the management of the mines and the direction of the working force. The right to hire must also include the right to discharge, and it is not the purpose of this agreement to abridge the rights of the employer in either of these respects. If, however, any employe shall be suspended or discharged by

the company, and it is claimed that an injustice has been done him, an investigation shall be conducted, as provided in resolution No. 22, and if it is determined that an injustice has been done, the operator agrees to reinstate said employe and pay him full compensation for the time he has been suspended and out of employment, provided, if no decision shall be reached within five days the case shall be considered closed, in so far as compensation is concerned.

In all such cases the other employes must continue at work pending an investigation and adjustment until a final decision is reached.

RESOLUTION NO. 24.

Resolved, That this agreement constitutes the only agreement between the miners and operators of this District, and that there shall be no demands made locally that conflict with this agreement.

Resolved, That this contract goes into effect April 1, 1902, and continues in force until March 31, 1903.

In witness whereof we have hereunto subscribed our names, this the 30th day of April, 1902.

District No. 23, U. M.

W. of A. by

C. Barnaby, President.

C. W. Wells, Vice-President.

W. J. Campbell, Sec'y and Treas.

W. R. Fairley,

G. W. Purcell,

} M. N. E. B., U. M. W. of A.

Western Ky. Coal Operators

Association by

I. P. Barnard, President.

F. P. Wright, Vice-President.

D. Stewart Miller, Secretary.

CONSTRUCTION OF 1902 AGREEMENT.

Following is the construction of the foregoing agreement as agreed upon by a committee consisting of D. Stewart Miller, Commissioner, C. Barnaby, President District No. 23, and J. D. Wood, M. N. E. B., U. M. W. of A.:

Central City, Ky., May 14, 1902.

To the Members of the Western Kentucky Coal

Operators Association, and the Members of District
No. 23, U. M. W. of A.:

Gentlemen—In accordance with the agreement come to in Central City at the joint convention held last month, we now beg to submit the following and hope the conclusions we have arrived at may be of benefit to the District generally:

In resolution No. 1 of the contract it is stated that "It is distinctly understood that when any company uses a shaker screen that screens more than a standard screen, they shall weigh coal in the cars on a run of mine basis." The wording of this resolution is somewhat ambiguous. The real and only intention of this resolution was to protect the miner and to insure him full weight for his coal in the event of the operator using for his own benefit a screen other than the standard screen, and the words "in the cars" were inserted in order to insure for the miner that protection; or in other words, to make it compulsory upon the operator to weigh the coal on a run of mine basis either in the cars or in a weigh pan above the screens; and when the operator elects to screen the coal first over the standard screen, the lump coal shall be weighed immediately after it has passed over the standard screen and before it passes over the shaker screen.

Resolution No. 10 of the contract states "that a square turn shall be kept all over the mines in rooms and narrow work under ordinary conditions." But this does not define what might be considered extraordinary conditions; to cover that ground we

hold that where the operator considers it necessary for the development of his mine to push forward his entries, he may do so, whether the rest of the mine is working or not, but that in common fairness the work should be distributed among those men in the employment of the company who are competent to do the work.

Resolution No. 11 states: "That miners absent from their working places for three consecutive days, shall forfeit their working places and any day man absenting himself without reasonable excuse shall forfeit his working place." Our attention has been called on more than one occasion to the fact that a certain class of men who do not want to work regularly, are constantly and systematically taking undue advantage of this resolution, to the great detriment of both their employers and their fellow-workmen; the wording of this resolution was not meant to protect in any manner the idle and thriftless element, and we hold that when men will not work regularly, and when they attempt to take advantage of the wording of this clause, they will be subject to discharge. The portion of this resolution relative to day men has in the past been somewhat misunderstood. We hold that where a day man absents himself from work one day, without previously obtaining permission to do so from the superintendent or bank boss, or has no valid or reasonable excuse for absenting himself without permission, he shall forfeit his position or working place.

With reference to resolution No. 13, on the subject of dues and assessments, we hold that the check weighman must, not later than the 5th day of each month, turn into the company's office an account showing the amount of dues and assessments to be stopped from each man for the previous month; by adopting this rule there will be no room for mistakes and misunderstandings.

With reference to that part of resolution No. 15 referring to shooting we hold that for the good government of a mine and for the safety of the employes it must be understood that under no

circumstances can shooting be done until nine hours after starting the run, or before the usual hour without the permission of the bank boss, and that he shall furthermore at all times direct how the shooting is to be done, and that consequently no man can be allowed to shoot out of turn.

With reference to boys between the ages of fourteen and sixteen years other than trappers, it has been decided that the scale of wage to be paid them for work underground shall be 91 cents per day.

In the Constitution of District No. 23, U. M. W. of A. Article 4, Section 2, states that "When a dispute arises between the employer and the employe the Mine Committee shall at once investigate the cause and on their failure to adjust the dispute shall call for the District president, who shall proceed to adjust the matter as in his judgment is best for the interest of the Union. But under no circumstances shall the work stop while such investigation is being made. Failure to comply with this section shall be sufficient cause to suspend the one or all affected."

And resolution No. 22, of the contract states that "under no circumstances shall work stop before the decision of the board of arbitration is received," and article 8, section 1 of the Constitution says, "Any local Union that shall willfully or neglectfully violate any of these laws shall, if proven guilty, for the first offence, be suspended from all rights and privileges for three months, and for the second offense, suspended for six months or as long as it is deemed best by the District Executive Board. It is therefore agreed that where local Unions violate resolution No. 22 of the contract, the penalty above referred to will be strictly enforced.

Resolution No. 23 states "That the operator and his superintendent and mine manager shall be respected in the management of the mines and the direction of the working force." It must be understood that the direction of the working force means in the case of day labor, that all day men shall perform whatever kind of day labor the management may direct them to perform

from time to time, and at any time should a day man be absent from work or should a day man refuse to continue at work pending the settlement of a dispute or from any other cause which would impede the operation of the mine; the bank committee on being appealed to by the bank boss shall do all in their power to provide the men necessary to carry on the work.

To prevent a man who voluntarily leaves the employment of a company when owing that company, leaving without first making some satisfactory arrangement for the future payment of his debt, it is held that secretaries of Local Unions must not in the case of a man leaving in such manner give him his clearance card until they have been advised by the company that such an arrangement has been made.

Local Unions must understand that no resolution passed in a local lodge in any way affecting the work of the mine can become effective until approved of by the operator, or his superintendent, and that in the case of the disapproval of the operator the matter will be settled by arbitration in the usual manner.

D. STEWART MILLER, Commissioner.

C. BARNABY, President.

J. D. Wood, M. N. E. B., U. M. W. of A.

CENTRAL KENTUCKY DISTRICT, 1903.

Following is the existing Western Kentucky agreement:

Louisville, Ky., March 31, 1903.

The members of the Western Kentucky Coal Operators Association, and Miners of the Western Kentucky Coal Field, in joint session, hereby adopt as the agreement for the ensuing year ending March 31, 1904, the following:

Pick Mining.**RESOLUTION NO. I.**

Resolved, That the price of pick mining for the year ending March 31, 1904, shall be 82½ cents per ton over the District Standard Screen (twelve feet long, five feet wide, one and one-half inch space between bars, five-eighths inch face). It is distinctly understood that when any company uses a shaker screen that screens more than a standard screen, they shall weigh the coal before it passes over said shaker screen. It is agreed that the ratio of lump coal to mine run over one and one-half inch district standard screen shall be based on 62 per cent. going into the weigh box, and this per cent. shall regulate the ratio of lump and run of mine coal whenever any change is made in the price of mining.

That the mine run price shall be 51 cents per ton, an equivalent of 62 per cent. of 82½ cents per ton, the price of lump coal.

It is understood that coal shall be mined two and one-half feet, and the solid may be shot not more than an equal amount, except at New Holland and Baskett, where miners shall mine coal as much as possible.

It is understood that the above prices apply to all veins that have been recognized at No. 9, or its equivalent.

RESOLUTION NO. 2.

Resolved, That the price of yardage in entries shall be \$1.25½ per yard, but when the entry exceeds ten feet, and is not more than twelve feet, the price shall be 93½ cents per yard, and no yardage shall be paid in excess of twelve feet.

All break-throughs shall be paid for at entry prices. Should the bank boss and the man driving an entry agree that it is wet, then the miner shall receive 31 cents per yard extra.

RESOLUTION NO. 3.

Resolved, That the price of turning rooms shall be \$3.75 per room.

Machine Mining.

RESOLUTION NO. 4.

Resolved, that the price for drilling, shooting, loading and timbering after chain and punch machines shall be one-half the price of pick mining, the companies using the chain machines to pay such additional price per ton for bradding the coal, handling the slack, and taking up the bottom, as can be agreed upon by the mines affected or have it done by the day.

RESOLUTION NO. 5.

Resolved, That the chain machine runners and helpers shall be paid at the rate of \$4.68 per twenty-seven cuts, under ordinary conditions, divided, \$2.48 to the runner and \$2.20 to the helper, and when they work by the day, the runner shall receive 31 cents per hour, and the helper 27½ cents per hour.

It is understood that fourteen square feet shall constitute a cut for the five-foot and the six-foot machines.

Resolved, That punch machine runners shall receive 31 cents per hour, and the helper shall receive 23½ cents per hour, when they work by the hour; 11 8-10 cents per ton of screen coal to

cutter, 7 cents per ton of screen coal to helper; or 1.25 cents per square foot to the cutter, and .75 cents to the helper.

RESOLUTION NO. 6.

Resolved, That the yardage for chain and punch machines shall be $62\frac{3}{4}$ cents per yard for three runs, and $46\frac{3}{4}$ cent per yard for four runs, to be divided as follows: Forty-four cents to the loader, ten cents to the cutter, and eight and three-fourths cents to the helper in chain machine mines when three runs are made; and in the same proportion when four runs are made.

Punch machine mines shall pay thirty-three cents to the loader, seventeen and one-half cents to the cutter and twelve and one-fourth cents to the helper when the entry is less than ten feet, and in the same proportion when the entry is twelve feet.

No yardage shall be paid by either machine company when the work is done by the day, nor when entries are more than four runs wide.

RESOLUTION NO. 7.

That turning rooms in machine mines shall be paid for by the yard, as per Resolution No. 6, divided between loaders, helpers and cutters, when not working by the day.

RESOLUTION NO. 8.

Resolved, That where a man or a man and a boy are loading after a machine, and not claiming more than a turn and a half, they shall be entitled to two rooms where practical.

RESOLUTION NO. 9.

Resolved, That the companies shall lay all roads and timber all bad places not caused by the miners' own negligence.

RESOLUTION NO. 10.

Resolved, That a square turn shall be kept all over the mines in rooms and narrow work under ordinary conditions, but when the operator considers it necessary for the extra or special devel-

opment of his mine to push forward the entries, he may do so, whether the rest of the mine is working or not; this work to be distributed amongst the men who are competent entry drivers. Half turn to boys between fourteen and sixteen years of age.

RESOLUTION NO. 11.


Resolved, That miners absent from their working places for three consecutive days unless through sickness, in which case they must notify the bank boss or by first having obtained the consent of the superintendent, or bank boss shall forfeit their working places, and men who do not work regularly and who attempt to take advantage of this resolution shall be subject to discharge. Any day man absenting himself from work one day without previously obtaining permission to do so from the Superintendent or bank boss, or who has no valid or reasonable excuse for absenting himself without permission, shall forfeit his position or working place.

RESOLUTION NO. 12.

Resolved, That any miner loading an unusual amount of slate, sulphur or other impurities, shall be laid off one day for each offense. The weigh-master and check-weighman to be the judges of such unusual amounts; and any miner laid off for three days during any one month shall then be subject to discharge.

RESOLUTION NO. 13.

Resolved, That check-weighmen shall have a number to run his account, and shall be allowed to cut each miner for his own wages, and for all dues and assessments of the U. M. W. of A., provided that in the case of dues and assessments each employe shall give a written order authorizing the employer to make such cuts. The check-weighman must not later than the third day of each month turn into the company's office an account showing the amount of dues and assessments to be stopped from each man for the previous month so that on the following pay day the



company may remit the amount of dues and assessments to the District Treasurer. Similar cuts for daymen shall be collected on the same conditions through the office. Men voluntarily leaving the employment of a company when owing that company shall not be entitled to their clearance cards until they have made an arrangement with the company for the future payment of their debts by giving them a sixty day note for the amount of the debt with authority to notify the company for whom they are going to work that they desire their wages cut \$4.00 per month until the note is paid in full, and the check-weighman or Secretaries of Local Unions shall not issue clearance cards until they have ascertained from the company whether or not the man applying for a card is in debt and until the aforesaid note has been given.

RESOLUTION NO. 14.

Resolved, That no mass meeting shall be held during working hours, on or off the company's premises, when the mine is running, and any one calling a meeting shall be subject to discharge.

No committee shall visit any employe at his working place, except in company with the bank boss, to settle a grievance; and any employe caught out of his working place during working hours, except for satisfactory reasons, is liable to have his turn stopped, at the option of the bank boss.

RESOLUTION NO. 15.

Resolved, That all labor shall be paid for by the hour, or quarters of hours, and that eight hours shall constitute a day's labor, so far as mine laborers and miners are concerned; but the eight hours shall not affect the engineers, firemen, pumpers, outside teamsters, night-watchmen, blacksmiths, or special repair work, or such men as are now paid by the month.

That an eight-hour day means eight hours work in the mines at usual working places for all classes of day labor and miners and any miner late, without reasonable excuse, shall forfeit his

turn for the day. This shall be exclusive of the time required in reaching working places and departing from same at night.

Regarding drivers, they shall take their mules to and from the stable, and the time in so doing shall not include any part of the day's work, their work beginning when they reach the change at which they receive the empty cars; but in no case shall a driver's time be docked while he is waiting for such cars at point named.

It is distinctly understood that the time of starting the run each day depends on the arrival of railroad cars, and that the eight-hours run shall be counted from the time of starting, provided the run begins within two hours from the regular starting time.

It is also understood that miners and day men will respond promptly to the starting time and that no shooting shall be done until nine hours after starting the run or before the usual hour without the permission of the bank boss who shall furthermore direct how the shooting is to be done and no man can be allowed to shoot out of turn subject to the penalties of Resolution No. 18 as hereinafter provided.

The following scale of wages shall be paid for inside work:

	Per Day.
Track layers	\$2 20
Track layers' helpers	2 00
Trappers	60¼
Bottom cagers	2 00
Drivers gathering with one mule	2 00
Drivers gathering with two mules	2 17¼
Drivers with more than two mules on entries	2 17¼
Riders	2 00
Water haulers	2 00
Timbermen	2 20
Pipemen	2 12
All other inside day labor	2 00
The minimum outside scale of wages for work about the mine shall be	1 60

The color line shall not be a bar to employment either above or below ground at any mine in this District which is a party to this contract.

In emergencies, and in the absence of any regular employe the right of the operator to employ men not members of the U. M. W. of A. for outside labor shall not be questioned. The men so employed as temporary employes shall not work more than three days at any one time without becoming members of the U. M. W. of A.

The initiation fee for admission to and qualification for membership in his District of the U. M. W. of A. shall not be in excess of \$10.00 for outside men.

The local conditions existing at each mine in respect to the rate of wages paid to men when taken from one kind of employment to another to fill temporary vacancies, shall not be disturbed.

That there shall be no boys employed as drivers, except on straight track, and said drivers shall receive twenty-five cents per day less than the District scale.

RESOLUTION NO. 16.

Resolved, That the price of blacksmithing at pick mines shall be 134-100 cents per \$1.00 earned by each miner, and at machine mines blacksmithing shall be 67-100 cents per \$1.00 earned by each miner.

RESOLUTION NO. 17.

Resolved, All employes affected by this agreement shall be paid on the second Saturday of each month for the labor performed during the latter half of the preceding calendar month, and on the fourth Saturday each month for labor performed during the first half of the current month. This second payment, as provided above shall be in the nature of a cash advance in even dollars.

RESOLUTION NO. 18.

Resolved, That employes are liable to be discharged for:

- (a) Disorderly conduct.
- (b) Gambling and shooting on the company's premises.
- (c) Taking coal, tools, timber, etc., without permission.
- (d) Firing before the run stops without permission of the bank boss.
- (e) Committing a nuisance in entries, air-ways, or necks of rooms.

RESOLUTION NO. 19.

Resolved, That in the event of an instantaneous death by accident in or around the mine, the miners and underground employes shall have the privilege of discontinuing work for the remainder of that day, but work, at the option of the operator, shall be resumed the day following, and continue thereafter. In case the operator decides to operate the mine on the day of the funeral of the deceased, individual employes may, at their option, absent themselves from work for the purpose of attending such funeral, but not otherwise. And in the event that the operator shall elect to operate the mine on the day of such funeral, then, from the proceeds of such day's operation, each person employed at the mine at which the deceased member was employed, shall contribute fifty cents and the operator \$25.00 for the benefit of the family of the deceased or his legal representatives, to be collected through the office of the company. Except in the case of fatal accidents, as above, the mine shall in no case be thrown idle because of any death or funeral, but in the case of the death of any employe of the company or member of his family, any individual miner may, at his option, absent himself from work for the sake of attending such funeral, but not otherwise.

RESOLUTION NO. 20.

Resolved, That married men shall at all times form the majority of all committees.

RESOLUTION NO. 21.

Resolved, That in all conferences, the employes of each mine, or especially the mine affected, shall be represented by not less than three employes of such mine, and that the voting power shall always be vested in such employes, but this does not preclude the presence of any officials of the labor organization.

RESOLUTION NO. 22.

It is agreed that if any difference arises between the operator and the miners at any mine, a settlement shall be arrived at without stopping work. If the parties immediately affected can not reach an agreement between themselves, the question shall be referred, without delay, to a board of arbitration consisting of two members, one to be the Commissioner, or a similarly designated official, selected by the operators, or his appointee, the other the President of District No. 23, United Mine Workers of America, or his appointee. In the event of these two being unable to reach a decision, they shall select a third member, and the decision of said Board of Arbitration shall be final and binding on all parties to this agreement, and those they represent. But under no circumstances shall work stop before the decision of the Board of Arbitration is received, and such stoppage of work, before the decision of the Board of Arbitration is received, shall be sufficient cause to discharge the Mine Committee and the party or parties causing the dispute, unless the committee show they have used due diligence to keep the men at work.

RESOLUTION NO. 23.

Resolved, The operator and his superintendent and mine manager shall be respected in the management of the mines and the direction of the working force. All day men shall perform whatever kind of day labor the management may direct them to perform from time to time, and at any time should a day man be absent from work on the failure of the mine boss to secure the

necessary man or men it shall then become the duty of the Bank Committee to do all in their power to provide the necessary man or men to do the work. The right to hire must also include the right to discharge, and it is not the purpose of this agreement to abridge the rights of the employer in either of these respects. If, however, any employe shall be suspended or discharged by the company, and it is claimed that an injustice has been done him, an investigation shall be conducted, as provided in resolution No. 22, and if it is determined that an injustice has been done, the operator agrees to reinstate said employe and pay him full compensation for the time he has been suspended and out of employment, provided, if no decision shall be reached within five days the case shall be considered closed, in so far as compensation is concerned.

In all such cases the other employes must continue to work pending an investigation and adjustment until a final decision is reached.

RESOLUTION NO. 24.

Resolved, That the erection of head frames, tipples, houses, buildings, scales, machinery, railroad switches, etc., necessary for the completion of a plant to hoist coal all being in the nature of construction work are to be excluded from the jurisdiction of the U. M. W. of A. Extensive repairs to, or rebuilding the same class of work shall also be included in the same exception. The employes therein to be excluded as above when employed on such work only.

RESOLUTION NO. 25.

Resolved, That this agreement constitutes the only agreement between the miners and operators of this District, and that there shall be no demands made locally that conflict with this agreement except when any change of conditions arrive that did not exist at the date this agreement went into effect in which case the Commissioner and District officials shall arrange the necessary adjustment.

Resolved, That this contract goes into effect April 1, 1903, and continues in force until March 31, 1904.

IN WITNESS WHEREOF we have hereunto subscribed our names, this, the 31st day of March, 1903.

District No. 23, U. M. W.

of A. by

C. Barnaby, President.

W. J. Campbell, Secretary.

C. Wells, Vice-President.

Western Ky. Coal Operators

Association by

I. P. Barnard, President.

F. P. Wright, Vice-President.

D. Stewart Miller, Com. and Sec.

J. D. Wood,

Joe Vasey,

W. R. Fairley,

} N. E. B. M., U. M. W. of A.

COAL CREEK-JELICO SCALE, 1902-3.

The Coal Creek-Jellico wage scale of District No. 19, as agreed by the joint convention of operators and miners at Knoxville, Tenn., August 16, 1902, represented by the undersigned committee:

First, that screened coal shall be paid for on the following basis:

No. 1	Under 2½ feet	89½c
No. 2	2½ feet to 2 feet 9 in.	83½c
No. 3	2 feet 9 in. to 3½ feet	77½c
No. 4	3½ feet and over	71½c

The above per ton of 2,000 pounds in weigh box.

Run of mines shall be 50c per ton of 2,000 pounds.

SCREENS.

Screens shall not exceed 72 feet superficial area, with 1¼ inch space between the bars. Pitch of screens to be so regulated from time to time as the necessity arises, so that the coal will run over them.

MEASUREMENTS.

Only coal shall be measured. The mining seam, bone coal and sand band, if measured, shall not be considered impurities.

TRACKS.

The company shall lay all tracks.

CARS.

To be handled as heretofore.

JELLICO YARDAGE.

The standard price of slate entries in the Jellico district shall be \$2.30 per yard; but when both top and bottom are blasted, the price shall be \$2.90 per yard; solid rock entries, \$3.21; rock top and slate bottom, \$3.69; entries, airways and all narrow work in coal, when used for entries, and airways, shall be 97c per yard. But when the slate parting occurs in the coal, and neither top nor bottom is blasted, the price shall be \$1.39 per yard in entries and airways, and when the slate is loaded out and does not exceed nine inches in thickness; over nine inches and up to eighteen inches in entries and rooms, 4 4-5c extra per ton shall be paid on the coal.

ROOM TURNING.

In high coal, \$2.42; in medium coal, \$2.72; in low coal, \$3.02; for double rooms in all coal, \$4.53.

COAL CREEK YARDAGE.

Where neither slate nor dirt has to be shot over the coal the price shall be \$1.07 per yard.

Where the slate is eighteen inches or less the price shall be \$1.61 per yard.

Where a man works single in an entry the price shall be \$1.52 per yard.

Where the slate exceeds eighteen inches in thickness, 3c per yard additional per inch shall be paid.

TIMBERING.

Prevailing conditions at Jellico and Coal Creek shall continue under the contract.

PICK SHARPENING.

Forty cents per month, but if mine does not run over one-fourth time, 10 cents; one-half time, 20 cents; three-fourths time, 30 cents.

DAY LABOR.

Classification.	Rate per Hour.
Inside driver, one mule	19c
Drivers, two mules	20½c
Drivers, three mules	21½c
Drivers, four mules	22½c
Head track layer	26¾c
Assistant track layer	19c
Trappers	6¾c
Timberman	24c
Timberman helpers	19c
Inside pumper and water bailer	19c
Outside pumper and water bailer	17¾c
Muckers or inside labor	17¾c
Coupler-man inside	16¾c
Coupler-man outside	13½c
Coupler-boy inside	8¾c
Coupler-boy outside	6¾c
Tip house men	17¾c
Outside driver 10 cents per day less than inside.	
Boy driver under sixteen years of age, 35 cents per day less than regular prices.	
Drum man	20c
Knuckle man	17¾c
Knuckle boy	13½c
Furnace man (digging his own coal)	20c
Furnace man and watchman	14½c
Outside labor, including slate dumpers and section men	13½c
Blacksmith	23½c
Pick sharpener	20c

HOURS.

Nine hours shall constitute a day's work.

HOUSE FUEL.

Lump coal, \$1.65 per ton delivered; nut coal, \$1.10 per ton, delivered. When an employe does not buy coal he shall pay 50 cents per month in the spring and summer and \$1.00 in fall and winter. When coal is thrown off of railroad cars the price shall be \$2.00 per month in the winter, \$1.00 per month in the spring and fall; 50c per month in the summer. No coal shall be picked up around the tip house or taken off of railroad or mine cars.

DEATHS.

In case of the death of an employe or member of his family, the following rules shall prevail:

Death by accident in or around the mine, the mine shall lay idle until after the funeral. Death of a grown person from natural causes, the mine will lay idle on the afternoon of the funeral. On the death of a child, the work will not lay idle but those wishing to attend the funeral may lay off to do so.

PAY DAY.

The pay day shall be the same as heretofore, except where otherwise regulated by law. Any employe desiring to leave the employ of the company shall receive his money at once or not later than five days after his notice is given.

CUT.

Dues and assessments to be collected from all mine employes through the office by the fifth of each month or on the first work done in the month and paid to the proper party authorized to receipt for same, the cut not to exceed one dollar in one month unless by special order from the employe.

ARBITRATION.

There shall be a board of arbitration and conciliation to adjust all disputes arising under this agreement composed of three

on each side, with power to select an umpire, and their decisions shall be final and binding on all parties to this agreement and those they represent, but under no circumstances shall work stop.

LIMITATION OF CONTRACT.

This contract shall expire by limitation on the 31st day of August, 1903.

This convention adjourned to meet at a time and place to be fixed by the president of District 19 and the operators' secretary of the convention.

(Signed)

J. W. HOWE, President.

JAS. R. WOOLDRIDGE, Sec'y.

Scale Committee for Operators:

W. T. LEWIS,
E. B. TAYLOR,
H. S. PLESS,
C. G. POPP.

Scale Committee for Miners:

G. W. EUTSLER,
W. H. FOSTER,
HILLERY HUMPHREYS,
S. C. WILSON.

JOE VASEY,

N. E. B. M., U. M. W. of A.

LAUREL COUNTY SCALE, 1902-3.**Laurel County Wage Scale of District 19.**

Entered into by and between the United Mine Workers of America and the undersigned operators of Laurel Co. Beginning September 1, 1902, ending August 31, 1903.

For mining and day labor as follows:

1st. For mining over present screens of $1\frac{1}{4}$ inch space, per ton of 2,000 pounds, $76\frac{1}{2}$ cents.

2d. Run of mines or coal from the pick, of 2,000 pounds, 56 cents per ton.

3d. Entry work per yard, \$2.05.

4th. Airways and break-throughs, 55 cents per yard.

5th. For turning single or wing rooms, \$2.25. Double rooms, double price to be paid for when widened.

DAY LABOR.

6th. Single drivers inside, one mule, \$1.73 per day.

Single driver outside, one mule, \$1.68 per day.

Spike team, two mules, \$1.85 per day. Three mules, \$2.10 per day.

Track layers, \$1.94 per day.

Tipplers and trimmers, \$1.63 per day.

Trappers, 60 cents per day. Trappers tending more than one door, 15 cents extra for each additional door.

Furnace man, \$1.40 per day. Boys, 75 cents per day.

Blacksmith, common, \$1.85 per day. Practical mechanic, not less than \$2.10 per day.

7th. Blacksmithing for sharpening all tools, 50 cents per month.

8th. Engineers not less than \$2.00 per day.

Firemen not less than \$1.50 per day.

9th. Wet entries, boss and miner to agree as to price. If they

can not agree committee and general manager to take the matter up and adjust same.

10th. For taking rock bottom or top \$1.00 per yard, one foot thick.

11th. House rent the same as last year.

12th. Doctor and house rent to be charged semi-monthly. Any one wishing to pay doctor shall be cut through the office for same.

13th. All wrecked cars to receive average weight.

14th. Pay day on Saturday nearest 1st and 15th of each month for all work done in previous half month.

14½. That all employes shall be cut for dues and assessments as follows: The miners over the tipple. The day men through the company office. To be paid to the proper committee authorized to collect same.

15th. Coal where there is black jack—That one-half cent per inch per ton be paid for black jack up to 7 inches. Price not to exceed eighty cents per ton for any coal. Coal to be cleaned by miner in working place from all impurities. Where coal is not cleaned the price shall be 76½ cents per ton.

16th. That a board of arbitration be appointed to settle all matters in dispute under this agreement, to consist of two men, one to be selected by the company and one by the miners, and those two to have the power to select an umpire, whose decision shall be final and binding on all parties to this agreement, and under no circumstances shall any part of the work be stopped during the life of this contract.

17th. Nine hours to constitute a day's work.

18th. Any employe wishing to quit work shall, by giving five days' notice, receive his money in full.

19th. In case of the death of an employe or member of his family the following rule shall prevail: Death by accident in or around the mine, the mine shall lay idle until after the funeral. Death of a grown person from natural causes. The mines will

lay idle on the afternoon of the funeral. On the death of a child, the work will not be idle, but those wishing to attend the funeral may lay off to do so.

20th. House Fuel.—Lump coal, \$1.65 per ton delivered; nut coal, \$1.10 per ton delivered. When an employe does not buy coal he shall pay 50 cents per month in spring and summer and \$1.00 in fall and winter. When coal is thrown off of railroad cars, the price shall be \$2.00 per month in winter and \$1.00 per month in spring and fall, and 50 cents per month in summer. No coal shall be picked up around the tip-house or taken off of railroad or mine cars. This clause to apply to those only who live on the job or adjacent to tipple.

Operators.—Laurel Coal Co., per J. W. Bastin, General Manager; Pitman Coal Co., by W. A. Pugh, President; Pittsburg Coal Co., by W. R. Ballow, Superintendent; Standard Coal Co., by J. W. Thompson, G. M.; Manchester Coal Co., by J. W. Harris; Star Coal Co., by S. L. Bastin, General Manager; Bastin & Pritchard, by S. L. Bastin, G. M.; G. W. Curvin, General Manager Crescent Mines.

Miners Committee.—J. W. Cox, Chairman Scale Committee; John Jeffrey, E. B. M.; John F. Bowden, Vice-President; J. W. Howe, President of District 19, U. M. W. of A.; John Lester, J. M. Bowman, Sol. Rockwell.

Approved by Joe Vasey, N. E. B. M. U. M. W. of A.

VIII.

ACCIDENTS FOR 1901.

For the year 1901, 21 fatal and 117 noteworthy non-fatal accidents were reported.

A summary of the fatal accidents has been given in Chapter IV., "General Condition of the Mines." Following is a descriptive list of the fatalities:

DESCRIPTIVE LIST OF FATALITIES, 1901.

1. 2.—January. American Coal & Iron Co.'s Mine: Edward Browder, miner; 43 years. Keg of powder exploded in room, caused by ignition of squibbing missed shot which Browder was cleaning out. Churn drill struck pin on sulphur band. Widow and three children. At same time Lawthorn Lynne, 14 years old, employed by Browder to assist him, was killed. January 23.

3.—January. Providence Coal Co.'s Mine: Ben Southard, driver; 25 years old. Caught between cars and rib while trip was in motion; crushed in hips, resulting in death. Unmarried. January 18.

4.—January. Central Coal & Iron Co.'s Central Mine: William Strong, driver; 35 years. Tried to fill lamp while trip was in motion; fell from car, striking head against track rail and otherwise fatally injuring himself. Widow; no children. January 23.

5.—March. Pittsburgh Coal Co.'s Mine (Henderson County): James R. Golden, miner; 38 years. Returned upon hanging blast; killed instantly. Widow and three children. March 20.

6.—April. Mount Morgan Coal Co.'s Mine: Ode Taylor, loader; 24 years. Killed by fall of slate in room. Widow. April 12.

7. 8.—May. Central Coal & Iron Co.'s Central Mine: Allen Bailey and Daniel Grady. Employed by contractors in sinking air shaft. One of them was in bottom of shaft and the other descending in a bucket. Rope broke. Both killed. May 22.

9.—June. Eagle Coal Co.'s Mine: Fan house boiler blew up (at night) and Walter Shelton, asleep near boiler, was killed.

10.—June. Procter Coal Co.'s Grinstead Mine: William Ranes, car trimmer at tipple; 36 years. Had started a loaded car with pinch bar. Brake of car was on "front" end. Running in front of the moving car, he attempted to climb up by grasping the brake stand; foot slipped, lost his hold, fell, and car ran over both legs, killing him. Widow and three children.

11.—June. East Tennessee Coal Co.'s Mine: No name given. Was with others timbering a new opening. Slipped and fell while raising a heavy collar in place; collar struck him on abdomen causing fatal internal injuries. June 18th.

12.—August. Reinecke Coal Co.'s Mine: Virgil Bowles, helper on electric locomotive; 17 years. Foot caught between bumpers; caused lock-jaw.

13.—September. Alpine Coal Co.'s Mine: Jas. Hanes, miner; 40 years. Killed by fall of slate.

14.—September. Mud River Mining Co.'s Mine: Robert Blades, 16 years old. Attempted jump on front end of a trip as first car reached mouth of slope. Slipped and fell; was dragged by car. Died from injuries.

15.—October. Monarch Mining Co.'s Mine: Press Minter, miner. Killed by fall of coal while mining a standing shot. Neck broken. Widow. October 25.

16. October. St. Bernard Mining Co.'s "Arnold" Mine: Elijah Pritchett, shooter. Killed by powder explosion in entry. Was filling cartridges, probably wearing lighted lamp at same time, or was opening keg of powder with pick. Either act was in violation of well-known rules at the mines. Two kegs of powder exploded.

17.—October. Pine Knot Coal Co.'s Mine: P. H. Buttram,

miner, 30 years. Killed by fall of slate, in a room just widened. Widow and two children. October 1st.

18.—November. Ashland Coal & Iron Ry.'s Mine, Rush No. 6: L. C. Harris, a miner; 44 years. Killed while trying to ride out of mine on loaded trip. On one of the cars were some old mine doors; said doors after passing through one entry door caught on the next and were pushed back over the loads and struck Harris in head. Widow and seven children. November 13.

19.—November. Carbondale Coal Co.'s Mine (W. E. Booth, Lessee): W. M. Sisk, miner; 41 years. Killed while mining down a standing shot. Widow and seven children. November 20th.

20.—December. North Jellico Coal Co.'s "Bertha Mine: Ed. Phipps, machine helper, was crushed by fall of slate in neck of room, which had just been finished. Skull fractured. Age, 22 years. Unmarried. December 31.

21.—December. In No. 1, "Jackson" Mine (Breathitt County), operated by R. T. Davis: John Haddix was killed by fall of slate. Was working on a pillar. Age, 20 years. Widow and one child. December 21.

NON-FATAL ACCIDENTS, 1901.

Following is a summary of the non-fatal accidents, omitting minor injuries, reported for 1901:

CAUSE	Serious		Not Serious		Total
	In	Out	In	Out	
Fall of top	22	....	15	...	37
Fall of coal	6	....	....	...	6
Mining machine	6	....	2	....	8
Kicked by mule	1	....	1	...	2
Cars	11	1	10	1	23
Riding trip	1	....	....	...	1
Blown through shot	1	....	2	...	3
Returned on blast	3	....	1	...	4
Bored into loaded hole	1	....	....	...	1
Firing shots	1	....	3	...	3
Filling cartridges	1	....	....	...	1
Powder explosion	1	....	....	...	1
Burnt by gas	2	....	....	...	2
In shaft: Falling missile .....	....	....	1	...	1
Scalded by steam .....	....	....	....	1	1
Machinery .....	....	2	....	...	2
Boiler explosion .....	....	1	....	1	2
Miscellaneous	8	3	5	3	19
Totals	64	7	40	6	117

DESCRIPTIVE LIST FOR 1901.

In the following lists descriptions are based on the statements made in the monthly reports of the company reporting.

Bell County.

Pineville Coal Co.'s Mine.—Mike Donahue, a miner; an adult.
Slightly hurt in back by fall of slate, February 20th.

2. James Martin, a miner; 24 years. Cut in leg by fall of rash between coal and roof, July 24th. Off 3 weeks.

3. James Shelthorse, a miner; 38 years. Jumped off incline ahead of trip; bruised about shoulders, July 30th. Not serious.

4. Jack Fortune, track layer; 30 years. Boy placed torpedo on track, exploded and shell made a cut above knee; July 30th. Not serious.

5. Felix Meeks, miner; 25 years. Riding on front of trip; foot hanging down low caught on a piece of slate; foot bruised and mashed; August 20th. Idle about 10½ days.

Excelsior Coal Mining Co.'s Mine.—Lige Benge, driver; 30 years. Caught under cars; leg broken in two or three places and hip mashed; February 11th. Recovered.

2. C. N. Lewis, miner; 48 years. Collar bone fractured by fall of slate; October.

National Coal & Iron Co.—Wm. Sewell, miner; 36 years. Collar bone broken and ribs bruised by fall of slate; May 3d.

2. Letcher Collett, miner; 32 years. Returned on blast; face and arms severely burnt; May 15th.

Tuckehoe Coal Co.—Lee Garrison, machine helper. Lost first joint of second finger of left hand as result of its being caught between frame and motor of electric mining machine, in April. Lost two weeks.

Boyd County.

John Wurts, Clinton No. 8 Mine.—William Ervin, miner; 25 years. Foot hurt November 15th by fall of slate. Lost two weeks.

2. Ed Roberts, miner; 22 years. Run over by bank car and leg broken, June 30th.

3. Greenville McMillen, miner; 30 years. Leg broken and body bruised by fall of slate April 3d.

4. John Lewis, miner; about 24 years. Collar bone broken by fall of rock, January 14th. Lost two months.

Butler County.

West Aberdeen Coal Co.—Olis Hanes, miner; 28 years. "Back dislocated" by fall of coal, January 25th.

Henderson County.

Arnold Coal Co.—Thos. B. Armistead, weighman; 45 years. Fell across railroad track, arm broken, in November.

Pittsburgh Coal Co.—Charles Stolz and William Carlton, miners. Attempting to fire two shots—had lighted one and while trying to light the second the first one fired; each person injured in the face. Occurred May 10th. Carlton resumed work May 20th, and Stolz on June 5th.

2. G. D. Spencer, bottom lifter; 30 years. Back slightly injured by falling slate. November 26th.

3. Jas. Shelton, driver; 24 years. Back injured. Collision with another driver, December 18th.

Corydon Coal Co.—James Mason, colored, driver. Eye kicked out by mule, April 24th.

Pittsburgh Coal Co.—Fred Trehamer, returned on a hanging shot; two ribs broken, March 20th.

Hopkins County.

St. Bernard Mining Co., Earlington No. 9.—John Gough, driller and shooter. Fall of loose coal; broke two ribs and collar bone. February.

2. Wm. Carler, drill miner. Finger much injured; caught in cogs of drill, March 27th.

3. Lucien Carroll, loader. Fired shot and was hit by flying coal. Slight hurt, April 2d.

4. Preston Cooper, colored boy. Leg broken. (Cause not given.) May 5th.

5. Tom Brown, hostler. Unloading machine; foot slipped on loose coal; fell and was ruptured. July 9th.

6. Morris Frazier, colored. Hauling coal at tippie car, jumped track and caught leg; small bone broken, August 4th.

7. Will Bronough, driver. Hauling wooden rails; used stick to beat mule; stick jammed against "rib" and penetrated leg; lost 18 days. November 8th.

8. Floyd Laffoon, driver. Wagon ran into fall of slate; caused sprain in right ankle. November 8th.

St. Bernard Mining Co., Earlington No. 11.—Will Sisk, driver. Lifting car on track; mule started; caught foot between car and prop; sprained ankle, March 21st.

2. Galen Burden, machine runner. Fall of gob injured back and hip, March 27th.

3. Chas. Burden, hostler for No. 2. Same fall injured his back and hip; severe bruises, March 27th.

In addition to foregoing three minor hurts are reported—those hurt being T. F. McMillan, S. Clark, Reuben Miles.

St. Bernard Mining Co., St. Charles.—Hozie Laffoon, water bailer. Fall of slate; thigh, head and face bruised, June 6th.

St. Bernard Mining Co., Hecla.—Hugh Van Leer, machine runner. Foot caught in machine and badly cut and bruised, July 9th.

2. James Wyatt, driver. Ankle badly bruised by contact with car, December 6th.

Slight injuries to Bud Rutland, Geo. Cook, and George White are also reported.

St. Bernard Mining Co., Arnold.—John Haddock, colored, driver. Train ran through open switch; ankle sprained.

2. Frank Level, hostler. Coal fell from face; caught left hand, cutting off two fingers, March 26th.

3. Joe Walker, driller. Ankle sprained, September 5th.

4. Marion Earl, colored, driver. Foot run over by loaded wagon, November 18th.

5. Geo. Miller, badly burned by explosion of two kegs of powder in entry. Was working with Elijah Pritchett. See account of that fatality, October 8th.

Slight injuries to Dan Conners and Randell McNichols, also reported.

Carbondale Coal Co.—Arthur Armstrong, colored, driver; 20

years. Car off track; caught between car and rib. (Injury not stated.) August.

2. Haddock Clark, miner; 27 years. Hand caught between brake and rib. (Injury not stated.) August 3d.

Crabtree Coal Mining Co.—H. H. Cariel; letting cars down on tramroad; foot mashed; no bones broken, July.

Monarch Mining Co.—Henry Johnson, colored, driver. Car jumped track; foot mashed between cars and "rib." January.

2. Ed McIntyre. Blown out shot; severely but not dangerously burnt. September 26th.

3. Andrew Smith, colored. Slightly burnt at same time and place as No. 2.

4. Buster Merritt, colored. Blown out shot; slightly burnt. November.

Oak Hill Coal Co.—Chas. Rice, colored, driver; 20 years. Caught between car and timber; shoulder dislocated; lost two weeks. June 8th.

2. Wm. Crockett, colored, machine runner; 24 years. Machine jack slipped; finger caught between jack and skid and severely mashed. Lost 10 days. June 8th.

3. Frank Gibbons, colored. Struck by flying coal; left leg broken. Light went out and couldn't get out of the way. December 6th.

4. Jas. Ferguson, colored. Finger broken. Caught between shovel handle and lump of coal.

Reinecke Coal Co.—Ed. Tompkins, colored, trapper; 14 years. Hand mashed; caught between door and car. January 23d.

2 and 3. Willis Thomas and Arthur Porter, loaders; 34 years and 17 years respectively. Set fire to gas in room; burnt about face and hands. March 4th.

4. John Tompkins, machine helper; 28 years. Small toe cut off by chain machine. April 27th.

5. A. J. Jackson, 39 years. Fall of loose coal; shoulder dislocated. June 3d.

6th. Charles Roberts, 13 years. Throttle valve on engine burst; scalded on leg. June 22d.

7. Albert Armstrong, 35 years. Slate fell on his stomach; sick four days. June 25th.

8. Charles Webb, machinist. Repairing mining machine; thumb mashed. July 18th.

9. Louis Feger, Superintendent; 56 years. Counting revolutions of fan; hand caught and badly mashed. September 3d.

10. Wm. Goodloe, helper on motor. Foot mashed; caught between motor and empty car. November 7th.

11. Ben Watkins, laborer; 22 years. Taking down slate; prop fell on him; right knee cap injured. November 21st.

12. Frank Carney, machine hostler; 35 years. Tangled in chain of machine; fell and broke left leg. December 5th.

13. Logan Lewis, driver; 17 years. Right arm dislocated; mule ran against him. December 13th.

14. Dave Jackson, loader; 37 years. Fall of slate, left thigh bruised. August 6th.

15. Jap Natcher, loader; 26 years. Fall of slate broke his leg. August 6th.

Knox County.

Ross Jellico Coal Co.—V. Higgins, driver. Foot caught in tail chain; injury necessitated amputation of big toe. Was racing with other drivers. October.

North Jellico Coal Co., Bertha.—S. R. Foley; fall of slate; compound fracture of ankle. February 4th.

2. Tice Cain, machine runner. Fall of slate; back and hips injured. Off nearly two months. October 21st.

3. W. R. Anderson, machine runner. Severely injured by fall of slate. Was with Ed. Phipps, who was killed. See account of that fatality. December 31st.

East Jellico Coal Co.—Frank Birch, 24 years. Fall of slate; leg broken. February 16th.

2 and 3. W. H. Nolin and Joseph Hembree; each about 40 years. Fall of slate. Nolin's shoulders severely bruised and dislocated. Hembree's legs broken above the knees. May 11th.

Laurel County.

Bastin & Pitchard.—Wash Tinsley, miner. Went back on a shot in a room next to his and it broke through on him. Bruised about face, head and on body. December 14th.

Lily Mine (Karl F. Bierach & Bro. Co.)—James Ealm, trapper; 16 years. Car jumped track and hit him; left leg broken. July.

Pitman Coal Co.—Grant Onkst, day laborer; about 30 years. Taking down slate, and same fell on him; three ribs broken and spine hurt. March 30th.

Standard Coal Co.—John Woodyard, miner; 46 years. Fall of slate; rib broken and body considerably bruised. Walking in two weeks. April 16th.

2. Isaac Tuggle, miner. Fall of slate; two ribs and collar bone broken. "Again at work in his place after being kept from work from July 11th to July 22d."

3. John Wood, miner. Fall of slate and coal. Confined from September 17th to 30th.

Muhlenberg County.

Black Diamond Coal & Mining Co.—John Bibb, coupler; 16 years. Arm caught between car and timber; small bone broken just above wrist. January 1st.

2. C. W. House, machine helper; 22 years. Fall of "slip" in coal, fracturing hip. October 26th.

W. G. Duncan Coal Co.—T. McRoy, driver. Jammed by mule against end of car. Slight injury. July 15th.

Ohio County.

Williams Coal Co.—R. E. Millard, driver; 24 years. Car left track; foot mashed. March 18th.

McHenry Coal Co., McHenry.—Allen Sharp, loader; 40 years.

While using pick something flew in his eye, putting it out. July 24th.

2. Geo. Hall, 40 years. Loaded car ran over foot. October 14th.

McHenry Coal Co.; Echols.—J. B. Hunter, loader; Sitting on rear end of empty car; machine backed into car and a tooth of cutter chain penetrated foot. January 18th.

2. Wm. Hollifield, loader with father; 15 years. Fall of slate; head cut; flesh wound. Confined a few days. May.

Central Coal & Iron Co., Render.—Wm. Kelly, miner; 30 years. Stepped between two loaded cars, jammed and broke leg. February 8th.

2. Nelson Render. Hurt by fall of slate; not serious. February.

3. Ed Holland, coupler; 22 years. Foot caught between bumpers of railroad cars and severely bruised. December 28th.

4. John Eidson, driver; 30 years. Caught between mine cars; foot crushed. Off forty days. July 1st.

Pulaski County.

Alpine Coal Co.—H. D. Howard, track layer. Back sprained by fall of slate. September 4th.

2. Tobe Penn, miner. Fell from moving mine car. Arm broken. September 17th.

Eagle Coal Co.—Robert Curtis, miner; 30 years. Fall of slate; nose, and back of head skinned and legs bruised. Recovered in a few days. April 9th.

2. Wm. Yanders. Scalded when boiler of fan-house exploded; not permanently injured. See account of Walter Shelton's death at same time. June 6th.

Union County.

American Coal & Iron Co.—Geo. W. Smith, miner; 45 years. Fall of slate; fractured hip. November 12th.

2. John H. Pleasant, miner; 35 years. Fall of slate; ankle fractured. December 3d.

Ohio Valley Coal & Mining Co.—Houston Webb, driver; 22 years. Ran into loaded car on straight road; thrown off and car ran over right foot; painful injury, but no bones broken. January 29th.

2. John Butts, tipman; 50 years. Dumping car of coal into wagon-chute; was lifting car with lever and chain; lever became disconnected and he fell, spraining ankle; laid up 30 days. June 6th.

Paducah Coal & Mining Co.—Chas. Welch, mine foreman; 40 years. While in shop steel flew in his eye, injuring sight. June 22d.

2. Jas. Sheely, driver; 35 years. Kicked by mule. Not serious. June 21st.

3. Fr. Gahagan, miner; 37 years. Fall of coal; collar-bone broken, June 14th.

4. Joe Crow, Jr., miner; 15 years. Fall of slate; not seriously injured.

Webster County.

Providence Coal Co.—R. M. Brown, coupler; 47 years. Hand crushed by wheel of loaded car. Off sixteen days. September 1st.

Sebree Coal Co.—D. L. Montgomery; thumb cut on mine car; slight injury. February 1st.

2. Elmo Terry; struck on arm by missile falling down shaft; slight injury. February 3d.

3. Vaughn Cissel; 32 years. Fired a shot by boring into it with grip auger; burnt about face and hands.

Whitley County.

Whitley Coal Co., Halsey.—Luther Rains; wiping belt of air fan; had on heavy gloves; top of left hand caught on pinion pulley, and arm was dragged between pulley and bearing timbers; gash cut in arm and bone broken. Lost six weeks; April.

West Jellico Coal Co.—Jas. Wickman, miner; 19 years. Fall of slate; arm injured. Lost a week. June 18th.

IX.

ACCIDENTS IN 1902.

For the calendar year 1902, 19 fatal and 129 noteworthy non-fatal accidents were reported.

A summary of the fatal accidents has been given in Chapter IV, "General Condition of the Mines." Following is a descriptive list of the fatalities.

DESCRIPTIVE LIST OF FATALITIES, 1902.

Bell County.—National Coal & Iron Co.: Walker Dean, miner; 35 years. Killed by fall of slate. Unmarried. January 31st.

2. Mike Lenon, miner; 50 years. Killed by fall of slate. November 17th.

3. Chas. Collett, trapper; 14 years. Was riding a trip. Killed by cars near tip-house. December 8th.

Bell County.—Black Raven Coal Co.: William Foster, machine helper. Killed by fall of slate; had knocked a prop down and failed to reset it. Unmarried. October 22d.

Bell County.—Pineville Coal Co.: Gus Andraces, miner; 44 years. Mike Stapas, miner; 23 years. Were asphyxiated by powder fumes, in consequence of returning to their working place immediately after shooting. Occurred in No. 1 Mine, on November 3d. The men were Greeks, and it is understood that both were married. The Assistant Inspector investigated the matter. His report is: "They were driving an entry and fired five shots. They went back immediately after the shots were fired. J. L. Moore and Robert Brown worked close to them. They (Moore and Brown) both say they told them not to go back, but to go out with them. They replied, 'We know our own business.' H. Mar-

tin, a driver, says he called to them to come out of the entry, but they refused. Jesse Gudger, who is an assistant to the mine foreman, says he put them to work and cautioned them to go out of the mine immediately after they fired the shots. The shots were fired at 3:30 p. m., and they were found at 5:30 p. m."

3. Wm. Stoneham, miner; 24 years; unmarried. Suffocated by powder smoke in same mine, under exactly similar circumstances as in above case, on November 24th. The matter was investigated by the Assistant Inspector, who reports: "He was working in a room and fired two shots; went back at once after firing, to light the third shot, and was overcome by the smoke and died before he could be gotten out. W. H. Burton says that he told Stoneham to not go back. He (Stoneham) replied that he had only fired one shot and was going back to light the others. Upon investigation, however, it was found that two shots had been fired."

Boyd County.—John Wurts, Lessee, Clinton No. 8: Harrison B. Gilbert, miner. Killed by fall of slate, September 13th. On the day of the accident Mr. Wurts forwarded the following report to this office:

"Harrison B. Gilbert was killed instantly this morning, about 6 o'clock, by a fall of slate in his room. The slate extended out over the coal about 1½ feet. Gilbert mined the coal back 2½ feet, cutting off a seam in the slate, when the coal, slate and all came down on him, breaking his neck. Gilbert was about 26 years old and leaves a wife and one child. There was about half a ton of the slate. Verdict of coroner's jury was: 'An unavoidable accident. Coroner A. H. Moore, Ashland, Ky.'" A later report places Gilbert's age at 34, and states that he had two children.

Carter County.—Strait Creek Coal Co.: "Two men killed by falling slate from roof." No particulars received. Occurred in May.

Daviess County.—New Holland Coal Co.—Eli McCleary, miner; 65 years. Killed by premature blast, February 23d.

Hopkins County.—Victoria Coal Co.: Henry Foxwell, 16 years old. Died from powder burns. Report is: "Caused by playing with powder; three kegs exploded in an empty car; caused his death two days later."

Knox County.—Hughes Jellico Coal Co.: John Orick, miner; 50 years. Killed by fall of slate in his room. Left widow, a son of 16 and a daughter of 15. September 5th.

Laurel County.—Manchester Coal Co.: C. C. Hatfield, miner; 52 years. Killed by fall of slate in his room, July 22d. The Assistant Inspector, who investigated the accident, reports as follows: "His son, Thomas Hatfield, was in the room with him. They were loading coal at the time. I visited the mine on July 26th and made an investigation of the affair. I found on examination that the man had failed to keep his room properly timbered, as it was eleven feet from face of room to the timbers. The mine foreman said that he told Thomas Hatfield on the evening of the 18th that they ought to prop their room. I also had a talk with two miners, Rudolph Struble and J. B. Bryant, and they said that they had warned Hatfield about his timbers. I afterwards visited Thomas Hatfield at his home, and he corroborated the statement of the bank boss, and also of Struble and Bryant. The slate that killed Hatfield was eleven inches thick at the place that the slip appeared, and ran to a feather edge." Hatfield left a widow and eight children, the youngest four years old, and two of them married.

Laurel County.—Laurel Coal Co.: Jerry Stringer, miner; 41 years. Killed by fall of slate, November 3d. Widow and six children.

Pulaski County.—Cumberland Coal Co.: Henry Stailey, miner; 35 years. Hit by trap door at blasting time and instantly killed. February 27th. Widow and two children.

Union County.—Paducah Coal Co.: Robert McCollum, miner; 58 years. Killed by fall of slate, December 4th. Unmarried.

Whitley County.—Pine Knot Coal Co.: Martin A. Love, miner; 55 years. Killed by fall of slate in his room, while setting timbers near face of the coal, August 20th. Following is the report of an inquest held by the magistrate:

“Pine Knot, Kentucky, Aug. the 20th day, 1902. This is to certify that at an inquest held over the body of Martin Love, deceased, a jury being summoned and duly sworn and instructed, after the examination of the body of Martin Love, deceased, and the examination of witnesses, returned the following verdict: We, the jury, give our verdict that Martin Love came to his death by accident of a fall of slate in the mines at Strunk, Ky. Signed: Marvin Ramsey, foreman; J. N. Frost, Thomas Chitwood, John Sawyer, Ves. Ramsey and Alf. Birch. Witness: R. F. Hickman, a justice of the peace for Whitley county, holder of inquest.”

Whitley County.—Procter Coal Co.: Perry Childress; 32 years old. Killed by side fall from entry, November 17th. Widow and one child.

NON-FATAL ACCIDENTS FOR 1902.

For the calendar year 1902, omitting the slighter injuries, such as bruises, mashed fingers, etc., 129 noteworthy non-fatal accidents were reported, of which 113 occurred underground. Following is a summary of the accidents:

SUMMARY FOR 1902.

CAUSES	Serious		Not Serious		Total
	In	Out	In	Out	
Fall of top	15	....	27	...	42
Fall of coal	8	....	8	...	16
Cars	7	2	9	...	18
Motor	3	....	....	...	3
Riding trip	2	1	4	...	7
Blown through shot .....	....	....	1	...	1
Returned on blast .....	....	....	1	...	1
Premature blast .....	....	....	3	...	3
Explosion	3	....	....	...	3
Powder explosion .....	....	....	2	...	2
Dynamite explosion .....	....	....	....	7	7
On slope	1	....	....	...	1
Mining standing shot (coal) .....	....	....	2	...	2
In shaft (cage)	1	....	1	...	2
Miscellaneous	3	2	12	4	21
Totals	43	5	70	11	129

Descriptive List for 1902.

In the following lists descriptions are based on statements made by the company reporting, unless otherwise indicated:

Bell County.

Excelsior Coal Mining Co.—Jasper Redman, miner; 35 years.
Fall of draw slate; femur broken. March 19th.

National Coal & Iron Co.—Wm. Shell, miner; 45 years. Fall
of slate; three bones in back injured. May 5th.

2. Wm. Ballon, miner; 22 years. Ankle and foot mashed by fall of slate, May 6th.

3. Robert Shields, miner; 35 years. Fall of slate; ankle sprained, but not badly.

4. W. O. Johnson, miner; 54 years. Coal fell while undercutting; collar-bone and one bone below knee broken. May 28th.

Pineville Coal Co.—Mayhew Mills, a greaser. Riding trip into mine; foot caught between cars and slightly hurt.

2. Dave Jones, laborer; 30 years. Jumped on moving train in the yards; thrown against car on parallel track and thigh bruised. June 5th.

3. Dan Robinson, driver; 18 years. Foot caught between cars and sprained, December 29th.

4. Robert Southers, miner; 20 years. Held lamp to loaded hole; shot discharged; injured in breast. Fully recovered. November 13th.

Boyd County.

Princess Land & Mining Co.—George Lusk, miner; 21 years. Knee injured by fall of coal; not serious. December.

2. James Sweet, weighman; 30 years. Struck in face by brake-rod of car; no bones broken. March 1st.

3. James McAllester, assistant mine foreman. Fall of slate; ankle sprained, but not seriously. November.

4. Howard Clark. Fall of coal; knee injured; not seriously. November.

Ashland I. & M. Co., Rush 6.—Andy Howell, miner; 46 years. Also William, son of same; 16 years. Pushing loaded car from room; front wheel left track, rear end of car flew up, catching their hands between car and roof. No bones broken. Lost a few days. October.

3. Charles Bartlett, miner; 26 years. Fall of coal while taking out a pillar; seriously injured in side and back. February 28th.

John Wurts, Lessee, Clinton No. 8.—Joe Lewis, driver; 28 years. Caught between cars; leg broken. Lost twenty-three days. January 20th.

2. John Spence, miner; 21 years. Fall of slate; back hurt; lost a month. March 28th.

3. Chas. Marcum, miner; 22 years. Hips hurt by fall of slate. Off about forty days. May 10th.

4. John Dority, miner; 35 years. Hips and legs hurt by a fall of rock. Occurred October 23d. On December 1st he was "able to go about without aid of crutches."

Butler County.

Bayles Baker, Lessee, Aberdeen Mine.—Lonny Phipps, miner; 35 years. Fall of top coal; leg broken.

Carter County.

Ashland I. & M. Co., Rush 10.—Robert Hall, miner; 47 years. Top coal fell; injured foot; not serious. February 12th.

2. Harrison Adkins, miner; 55 years. Cutting heel of standing shot; top coal fell; back slightly injured. August 7th.

3. John Doerr, miner; 27 years. Pulling down top coal, after removing bottom bench; piece fell, knocked out prop sustaining cross-piece over road, letting rock fall, which knocked him against car, mashing nose. Out 14 days. August 16th.

4. James Barney, miner; 30 years. Fall of top coal and slate; foot slightly injured. No bones broken. September 3d.

5. Clifton Bunting, coupler; 16 years. Attempted to couple cars while in motion; hand mashed between bumpers, and left little finger mashed off. September 4th.

6. Dave Pennington, miner; 23 years. Fall of top coal; struck on head and shoulders; only slight injury; lost no time. October 10th.

7. Chas. Lowe, miner; 35 years. Fall of top coal, which he was preparing to shoot down; left arm broken above elbow. November 15th.

Hopkins County.

Oak Hill Coal Co.—Dick Farmer, laborer; 35 years. Foot caught in frog of track; cars ran over it. Lost two weeks. December.

Reinecke Coal Mining Co.—Louis Durrett, hostler; 25 years. Fall of coal; left ankle out of joint and badly bruised. January 13th.

2. F. P. Haynes, watchman on top; 58 years. Fell in hole; left hip temporarily injured. February 8th.

3. Percy Dial, trapper; 15 years. Slipped on rail; three cars ran over him; broke left leg. March 7th.

4. Henry Brown, machine runner; 45 years. Riding loaded car; caught between car and roof; left shoulder and neck hurt. March 29th.

5. Ellis Strum, loader; 45 years. Fall of slate; injured knee and ankle. November 1st.

6. James Bradshaw, driver; 30 years. Caught between loaded car and roof; shoulder bruised. November 7th.

7. Turner Blackwell, trapper; 14 years. Motor ran against door; latter knocked him down, slightly fracturing skull. November 26th.

St. Bernard Mining Co., St. Charles.—Joe Reynolds; finger caught between bumper of car and rail; end mashed off. November 7th.

2. M. I. Sweeney; dressing room; top coal fell, bruising him severely. November 28th.

St. Bernard Mining Co., Earlington No. 11.—John Snorton, loader. Cleaning coal from car wheel; mule started; finger run over and crushed. February.

2. James Morris, driller. Riding in car with loose drills; car jumped track, a drill fell out, was stepped on by mule; end flew up and wounded wrist of Morris. March 4th.

3. Phillip McMonus, driver. Slipped and fell while slewing car; strained back and bruised arm. March 7th.

4. E. Anderson, loader. Bruised by fall of slate; not seriously. April 17th.

5. John Cloren, driver. Car left track; jammed finger against rib; amputation of finger. June.

6. Will Greggs, driver. Going down grade with several loaded cars; turned to call to driver behind him; struck head against roof and fell off; thigh fractured. October 13th.

7. Chas. Tatum, loader. Fall of top; ankle sprained and bruised, and body bruised; not seriously. October 18th.

Minor injuries to the following also reported: Wilbur Nelson, bruised between car and rib; Henry McGuire, John Ampler, Lee Jackson, Joseph Stumett, Tom Edwards, Wm. Vanason.

St. Bernard Mining Co., Hecla.—Leslie Patterson, driver. Putting front wheels on track with mule fastened to car; mule started; man fell and strained foot. March 5th.

2. Ed Williams, driver. Kicked in face by mule; not serious. April 23d.

3. Eugene Vincent. Attempted to jump on empty trip in motion; right foot caught and crushed; amputation necessary. August 30th.

Slight injuries to the following were also reported: John Knox, Joe James, John Jennings, E. E. Witherspoon, Geo. Yancey, Roland Woodson, Solomon McLean, Sam Eaves, Wm. Faulkner, Ezell Coffee, Harvey Graham.

St. Bernard Mining Co., Diamond.—Marshall Hamilton; tipping coal; let carriage fall on foot; toe badly mashed. May 6th.

2. John Bass, driver. Riding front end of loaded car; driving fast; driver in front stopped; Bass jumped off; arm caught between top of car and roof and was broken. May 7th.

St. Bernard Mining Co., Barnsley.—Robert Walsh, machine runner. Bruised badly by fall of coal. October.

2. Lige Robinson, driver. Fell getting on car and broke leg. November 25th.

Slight injuries to the following were reported: Sam Ames, Robert Welsh, Arthur Turner, Claude Bowers.

St. Bernard Mining Co., Arnold.—Melton Grigg, laborer. Jump-

ed out of cart and fell as cart-mule started up. Wheel ran over leg; broke both bones four inches above ankle. March 26th.

2. Ben Dade, hostler. Instep injured by piece of coal falling on it. Lost 10 days. September 10th.

Slight injuries to the following were reported: Will Ewing, John Phillips, Sam Morgenheimer, Ben Fitzpatrick, Jim Pinkston, Tom Logan, Dock Sanders, Gus Childs.

St. Bernard Mining Co., Earlington No. 9.—Albert Waters, timberman. Let cars get away on slope; in collision was injured in foot and hip. January 18th.

2. Thos. Clark, miner. Returned on a hanging shot; met the explosion; burnt and cut about face; not very serious. April 11th.

3. Henry Sergeant, hostler. Attempted to get on trip carrying men to work; lost his balance and got squeezed between car and rib. Lost 24 days. June.

4. Geo. Allen, loader. Fall of slate; hip bruised and three fingers mashed. July.

5. Foster Green, spragging cars on tippie; finger caught and end mashed off. August 5th.

6. Ben Kendall, driver. Empty car jumped track; hand caught between car and rib; fore-arm fractured. August 21st.

Slight injuries to the following were reported: Garland Anderson, John Snorton, Mat Hilton, Wm. Smith, Henry Ray, W. Holt, Geo. Miller, Shelly Cheatham, Dave Bradley, Ernest Hyde, Lee White, Milton Herndon, Tom Crawford, Dennis Fletcher, Sam Quarles.

Victoria Coal Co., Monarch.—Tom Johnson; 21 years. Fell from ascending cage at quitting time; leg broken at ankle, and jaw broken. February 16th.

2. Alf. Bradley, driver. Car ran on foot, cutting it. May.

3. Granville Drake. Caught by passing loaded car while sitting near track; hips and side squeezed; disabled 30 days. September 1st.

Knox County.

Artemus Jellico Coal Co.—Lenk Kinder, miner; 32 years. Fall of slate; left hand crushed, necessitating its amputation. May 22d.

East Jellico Coal Co.—Bush Lumpkins; 23 years. Car jumped track, knocking down prop and causing fall of slate; one rib broken, back badly bruised. March 16th.

2. Robert Licklitter; 21 years. Fall of top; back injured; not seriously. March 20th.

North Jellico Coal Co., Bertha.—John Moss, trip rider. While riding on motor, leg was caught in a narrow place; contused wound on leg and ankle broken. May 14th.

2 and 3. Roscoe Sexton and Wm. Westerfield, injured by slate fall. Westerfield received contusion of ankle; Sexton was severely bruised about hips and back. July 26th.

4. Richard Mullins, loader. Fall of slate; foot crushed and ankle dislocated. September 8th.

5. Henry Sullivan; hand lacerated by mine car wheel; amputation of little finger necessary. November 2d.

6. Allen Sevier, trapper; 14 years. Caught and dragged by trip of cars, and left leg injured. Was running alongside the cars, holding on with one hand, and disregarded warnings from drivers and others. Amputation was necessary. Gangrene subsequently set in, from which the boy died.

North Jellico Coal Co., Wilton.—P. H. Bunn, superintendent; 32 years. Foot caught under coal tip; two toes broken and one mashed. February 17th.

2 and 3. John Hutchins (32 years) and Alex. Salyers (50 years). Assisting in taking down slate. "The gin hands were wedging the slate down, and for some reason these two men insisted on getting under the slate, and were warned several times to keep out." Slate fell, bruising both men, but neither one dangerously. Hutchins was able to work next day.

4. Sel. Harney, loader; 21 years. Fall of draw slate; back and breast hurt. Had failed to prop. July.

5. John Cox, machine helper; 27 years. Riding front end of motor, which was pushing water car; latter jumped track; foot caught between motor and car, and small bone broken. August 26th.

6. Eugene Mitchell, loader; 21 years. Fall of slate; right leg bruised. September 30th.

7. J. T. Prewitt, loader; 40 years. Fall of slate; body bruised and slight sprain through hips. November 23d.

8. Chas. Smith; fall of slate; compound fracture of ankle. November 25th.

9. Frank Engle, loader; 25 years. Fall of slate; back and left lung injured. November 27th.

Laurel County.

Leota Coal & Coke Co., Lily.—James Mullens; 50 years. Working on entry stump; hurt by fall of slate. June 6th.

Standard Coal Co.—Robert Owens; back and arm bruised and two lower ribs loosened by fall of slate. Stephen Quinlan had arm and hand bruised at same time. October 2d.

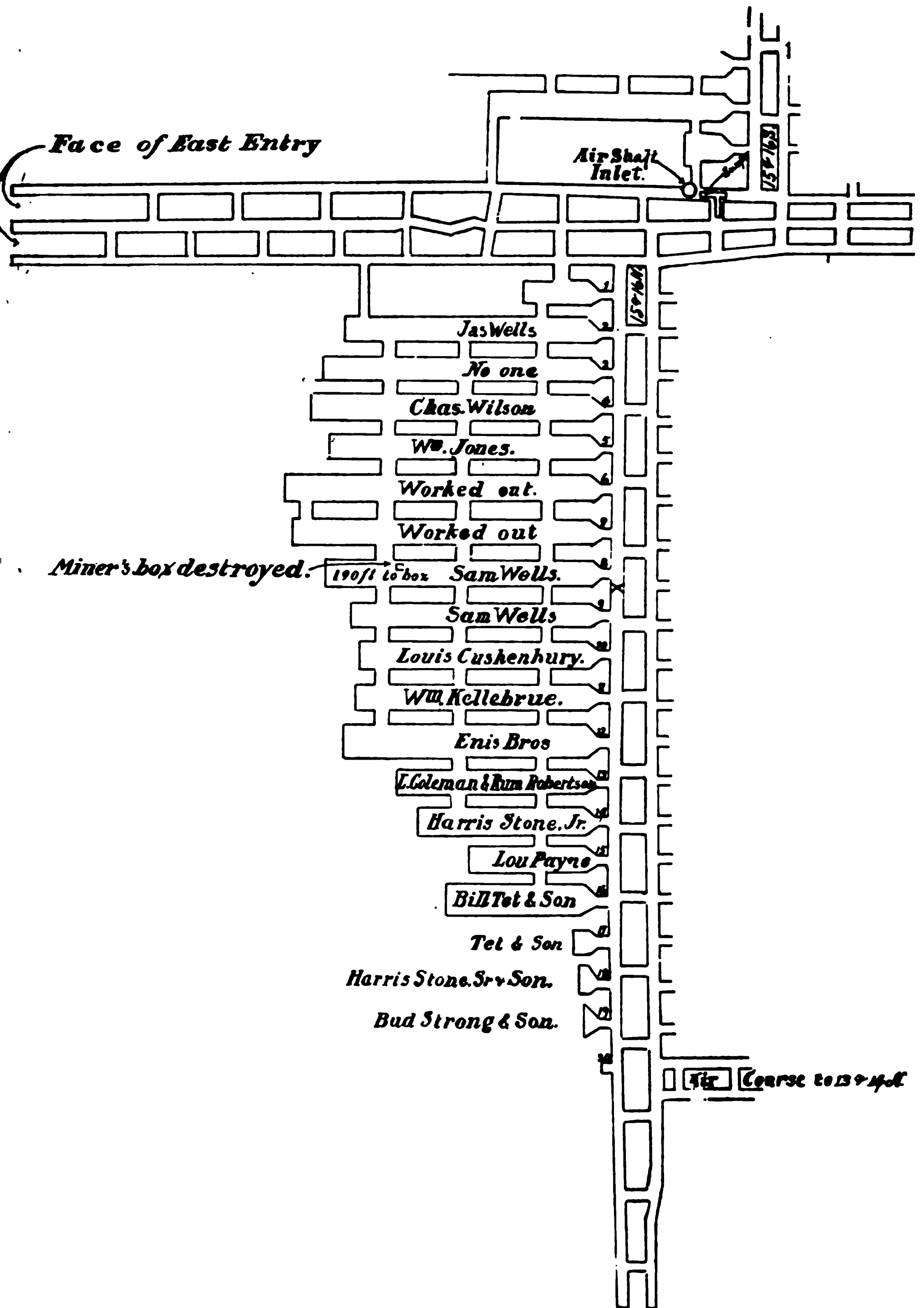
3. Two men (names not given), "slight fall of slate on December 31st." Report says: "No bones broken, and parties will be at work within the week."

Pitman Coal Co.—Chris. Irvine, miner; 28 years. Shot broke through rib; coal struck him on head; not serious. December 5th.

New Diamond Coal Co.—E. M. Smith; coming out of room, when rope hoisting coal on that entry broke, letting two cars run back on him; legs crushed considerably. Report said: "Will probably lay him up two or three months." November.

Morgan County.

Kentucky Block Cannel Coal Co.—Isom Wadkins and John Allen, slightly injured by premature blast. April.



Muhlenberg County.

W. G. Duncan Coal Co.—Tom Lee, driver. Caught between car and rib. Lost 8 days. May.

2. Philip Ashoff; hurt while mining under a standing shot. Lost 10 or 12 days. June.

3. A driver (name not given) got hand caught between car and rib. "Lost several days." September.

Central Coal & Iron Co., Central.—On February 15th an explosion occurred on the '16th north entry, in which three men—Rumsey Robinson, Horace Stone and Samuel Wells—were severely burnt. The origin of the explosion and its precise nature is in question. At the time it occurred, there were nineteen rooms and a neck on the entry, all on the same side, rooms 18 and 19 being but little more than fairly-well widened. All rooms up to No. 16 inclusive were connected by break-throughs. A diagram of the entry and rooms, as prepared by the company, is given herewith. There were curtains between rooms 4 and 5, 8 and 9, and between 14 and 15. The air-current was traveling from the air-course of East Main into room 2, and thence toward the upper rooms on North 16.

The injured men assert that the explosion followed and was due to the firing of a shot in the short room, No. 18, and that the destruction of a miner's tool-box, which was found torn to pieces in room 8, was due to the force of the blast accompanying the explosion. The company claims that it was a powder explosion, originating with one of the injured men, who they think was getting powder from the box in room 8. The company's statements and theories, as given in letters received from the general manager, are as follows:

1. Report of the mine foreman, W. L. Russell, as to curtains, etc.: "The first curtain was between the air-course and No. 1 room; not hurt. The second curtain was between No. 4 and No. 5 rooms, and was already torn partly down. The third curtain, between rooms 8 and 9, and not hurt. The fourth curtain was

between No. 14 and No. 15, and was blown down. The last break-through in each room was open; the break-through between 11 and 12 rooms was open to air the eight rooms on 15th North.

"In No. 12 room was Louis Quissenberry, who was holding his shot, waiting for No. 11 to finish tamping. In No. 11, Wm. Killibrew said he was tamping his hole and thought the explosion was merely a big shot. No. 12 [13] was also waiting on No. 11 to finish tamping, and was back near the break-through. The explosion did not blow out their lights."

2. Extracts from statements and suggestions of the manager: "There were but two shots fired on this entry, one in room 13, and the other in room 18; there was no shot in room 8, where the miner's box was blown to pieces." "Though the course of the air was direct from No. 8 through the break-throughs to the last room, those men who were in rooms 11, 12 and 13 were not affected at all by the explosion, and, in fact, knew nothing of it; their lamps were not even blown out." "The man working in No. 8 was out of his room, as you have no doubt learned, and the miner, who was Horace Stone, had left his room and come to No. 8, we think, with the intention" of getting powder, "and while there, through carelessness, exploded the supply in the box and burned himself." "The man Stone, who was burned, claimed to be in the 16th entry—I think about room 10—yet his hands were badly burned, and it seems to us very clear that he had the material in his hands that caused the explosion; in other words, we think that he was probably" getting powder, "and was loading his cartridge when the loose powder took fire, probably from his lamp." "Surely, if he was in the entry at the place he states, and was burned at that point, there would be more evidence of the effect of that fire in the neighborhood; but the fact remains that the curtain, but a short distance from him, and also the split in the break-through were neither of them affected at all." "The fact that the curtain between 8 and 9 was not injured, while that between 14 and 15 was blown down, shows to my mind conclusively that the explosion which destroyed the box in No.

8 followed the course of the air through the break-through, and hence destroyed the curtain at Nos. 14 and 15, but its force was spent before it reached the one between 8 and 9."

3. The report of the Mine Committee, dated Feb. 17, 1902, is as follows:

"We respectfully submit the following as our report, after carefully interviewing the injured parties who were burned in the explosion occurring in the Central mines, at Central City, Ky., about 4 o'clock p. m., Feb. 15, 1902: Rumsey Robinson, colored miner, said he worked in No. 13 room in the 16th North entry, east side. When the shots were being fired in other places, Robinson started for the neck of his room, leaving Lawrence Coleman at the face of the room to fire the shot. When he reached the room neck the explosion occurred. He shortly afterward heard Horace Stone, another colored miner, calling for help. Coleman came to their assistance and brought them out to the mouth of 15th North entry. We were informed by friends of Horace Stone that his injuries would prevent an interview. Samuel Wells, colored miner, interviewed, stated that at the shot-firing time he went to the break-through between rooms 8 and 9, intending to borrow a squib from miner Lewis Quisenberry. He heard Will Jones, colored miner, coming up in the room, and he stopped in the break-through between Nos. 8 and 9 rooms to borrow a squib from him, when the explosion occurred. The force of the explosion blew him across room No. 9, against a prop. His toolbox, which was setting along the rib near where he was standing, was blown in the opposite direction, toward No. 7 room, together with his dinner bucket. The box was badly broken. In reply to the question of how much powder he had in the box, Wells claims to have borrowed $3\frac{1}{2}$ feet of powder from miner Killebrew, and had none on hand at the time. (Signed) Mine Committee: John Kuck, John Anderson."

I visited the mine on Monday, February 17th (the explosion occurred on Saturday), and made as careful a study of the conditions subsequent to the explosion as possible. All things in

entry and rooms were said to be just as they were after the explosion, except that a car, which had been standing in the entry near room 11, had been run into the neck of that room. Upon examining the face of room 18, in which the shot that the miners claimed had caused the explosion was fired, I could find no evidence of a blown-out or partly-blown-out shot. The coal seemed to have broken pretty well toward the bottom of the hole. I could learn nothing as to the amount of powder used. I found that a small part of the tops of the slate stoppings in third and fourth break-throughs (from the face) between entries 15 and 16 appeared to have blown toward entry 15, and that the top of the fifth break-through, about opposite room 18, was open. I found that the curtain, and also one side of the curtain frame, between rooms 14 and 15 had been blown away, and that they were blown toward the *mouth* of the entry, that is, toward 14 and *against* the course of the air-current. On the leg of the curtain-frame, which had been left standing, I found charred coal dust. The char was on the upper side of the post, *i. e.*, on the side toward room 18. On one end of the car which had been standing in the entry, near room 11, at the time of the explosion, I also found charred dust. The char was on the end pointing up the entry, *i. e.*, toward room 18. The curtain between rooms 8 and 9 was standing and had not been injured, showing that the force of the blast which had torn away the curtain between 14 and 15 was either expended before it reached room 9, or had kept in the track of the air-current and had entered rooms 10 and 9, and so on toward the lower rooms. In room 8 I found a much torn-up miner's tool-box, lying on the right side of the road, toward a break-through into room 7. Various things were strewn on the floor as if from the box, among them the top of a bucket. These things were between the remains of the box and the right rib of the room, that is, toward room 7. My first presumption was that the box had been blown up, but upon closer examination I could see no burnt-powder stains on the box where one would have expected to find them. One end of the box was bent outward and the other

end bent inward; the top was thrown off, and the contents of the box were lying as if pitched out by the sudden stoppage of the box—not as if thrown out by an explosion. My understanding from the men was that only one shot was fired, namely the one in room 18, but the manager speaks of the firing of one in room 13 also. My understanding from the men also was that Horace Stone (or Harris Stone, as the name appears on the diagram) was between the curtain at rooms 14 and 15 and room 18 when Rumsey Robinson heard him calling. The manager places him in room S. where, on the contrary, Samuel Wells claims to have been. Apparently the manager had names confused. The statement of Wells that his box was blown toward No. 7, while he was blown in an opposite direction, “across room 9,” is rather puzzling, except upon the theory that there was an explosion near him in room 8. Therefore, while it did not seem as if the box in room S had been blown up by powder, I would not undertake to say that there was not an explosion of powder in the vicinity of it. As regards conditions in the entry, however, one thing is quite clear, whatever may have caused the explosion there. Coal dust was on fire, moving down the entry toward the room in which the box was, and just as it would have done had it been set on fire by a shot in room 18. The charred coal was on the upper side of the curtain-frame and on the upper end of the car, and the curtain between 14 and 15 was blown in the direction it would have blown had the blast come from the direction of room 18, and not as if the force had come from room 8. If the “box” in room S had fired the dust, the flames would have moved toward the fan (which is a down-cast) and not from it. I am of opinion, therefore, that even if the theory that the man in room 8 accidentally fired some loose powder there be correct, there was some other cause which set fire to coal dust between the curtain at rooms 14 and 15 and room 18, and that it was between said curtain and the face of the entry. Whether it was a heavy shot in room 18 or loose powder in the hands of some one in that direction, I have no evidence.—C. J. N.

Central Coal & Iron Co.'s Powderly Mine.—S. R. Wiggins, miner; 32 years. While riding in a car, had hand on edge; car jumped track; fingers badly mashed between car and rib. Lost no fingers. Lost about two weeks. September 22d.

Ohio County.

Green River Mining, Manufacturing & Transportation Co., Jamestown.—A. T. Coffman, weighman; 65 years. Caught between cars and tipple; ankle crushed. July 26th.

Williams Coal Co.—Henry Blackburn, miner. Shooting slate; caught by fall of slate and collar-bone broken. October 17th.

Minor injuries were reported as follows: A Gaddis, bone of hand knocked out of place, October 21st; Dan Herrel, hand struck by sledge, in September.

Central Coal & Iron Co., Render.—I. K. Pearce, motorman; 23 years. While riding on front seat (contrary to standing orders), collided with two empties which had been lost by other motor. Left leg fractured in two places below knee. February 5th.

2. John W. Roeder, cager; 30 years. Caught under cage; bruised considerably; lost about 24 days. June 6th.

3. Robert Francis, driver; 24 years. Kicked by mule; nose broken. Idle 4 days. September 2d.

McHenry Coal Co.—Azro Myers, machine helper; stepped off machine; leg gave way; strained knee joint. February 10th.

2. Chas. Brown, driver; 22 years. Mule ran away; right hip sprained, but not seriously. December 15th.

Pulaski County.

Cumberland Coal Co.—Wm. Shelton, miner; 38 years. August 3d. "Leg and foot hurt."

Indian Creek Mine.—E. Hutchison, miner; 40 years. Fall of slate in room; back and sides bruised. Off 10 days. Props have been knocked out by a shot; went to loading without resetting them. January.

Union County.

Ohio Valley Coal & Mining Co.—James Sprague, miner; 52 years. While mining out solid that had been shot, coal fell and broke one of his legs above knee. May 14th.

B. C. Davidson & Sons.—B. C. Davidson, operator; 39 years. Foot mashed by breaking of rail when stocking coal. Amputation of small toe of right foot necessary. May 13th.

Webster County.

Sebree Coal Co.—James Pearce, trackman; 35 years. Loyd Carnell, driver; 19 years. Fall of top. Pearce hurt in back; Carnell's right hand mashed. Both painfully, but not seriously, injured. August 1st.

Providence Coal Co.—Monroe Butler, driver. Car jumped track; ankle fractured. Disabled five weeks. August 11th.

2. P. P. Fleming, miner. While climbing ladder out of shaft, slipped and fell to bottom. Sprained side and back, but not seriously. November 28th.

Whitley County.

East Tennessee Coal Co.—M. N. Willie, miner; 52 years. Fall of slate; broken thigh bone and internally hurt. September 29th.

Hoffman & Berry.—L. E. Edmonson, miner; 35 years. Fall of slate; finger mashed and hand bruised. January 29th.

Whitley Coal Co., Halsey.—Thomas Monday, miner; 25 years. Fall of draw slate in room. Cut over right eye and bruised in side and back. February 13th.

2. James Willis, miner; 39 years. Same time and place as above. Bruised in back.

Jellico Coal Mining Co.—Following were injured by explosion of dynamite: Job Jones, miner, age 50; J. A. Gothard, trackman, age 45; James Angel, furnace-man, age 62; John McCree,

laborer, age 35; John Hatfield, driver, age 23; John M. Davis, track-layer, age 25; Howard Jenkins, assistant track-layer, age 27. None seriously injured. Dynamite had been placed by fire to thaw. January.

Mt. Morgan Coal Co.—Wm. Thomas, miner; 38 or 40 years. Injured by fall of slate. "Confined to bed few days." April 16th.

2. Clarence Hall, driver; 29 years. Slate fall; broken jaw and bruised arm and leg. May 14th.

3. M. W. Meyer; 32 years. Slate fall. While repairing door knocked prop frame out. Broken rib. August 29th.

4. Wm. Jarboe, driving entry; 51 years. Hip thrown out of place. Cause not stated. December 22d.

Watts Creek Jellico Coal Co.—James Blair, miner; about 50 years. While undercutting fire-clay parting, fall occurred, and leg was broken. February 27th.

West Jellico Coal Co.—Wm. Taylor and John L. Ross. Were making cartridges, with keg containing about 18 pounds of powder open between them. Ross had a wet squib and tried to dry it by his mine lamp. Squib caught fire and jumped into open keg. Both severely burned about face and shoulders, but not dangerously. September 8th.

Pine Knot Coal Co.—Frank Martin, miner; 50 years. While making a break-through, coal fell and broke his leg between knee and ankle. July 16th.

X.**NOTES ON THE MINES.**

In the following notes on the individual mines, only the last inspection made under the administration of the present writer's predecessor, in 1901, is given, unless some especial reason exists for quoting from other inspections made in that year.

NORTHEASTERN DISTRICT.

The following counties, producing commercial coal in 1902, lie within this district: Boyd, Breathitt, Carter, Johnson, Lawrence, Lee, Morgan.

Output of bituminous coal in 1902, in tons.....	686,039
Output of cannel coal in 1902, in tons.....	58,865
Total tons shipped from mines in 1902.....	674,418
Production of coke in 1902, in tons.....	23,075
Employees for 1902: Maximum, 1,950; average.....	1,678
Average number of days worked in 1902.....	230

Boyd County.

The output of the Ashland Iron & Mining Co. for 1902 was reported in such shape that it can not here be given in classes, hence the entire product of that company is necessarily included in the miscellaneous class.

Following are the returns for 1902, for each mine in the county:

MINE	Miscellaneous	Total
Clinton No. 8	99,116.45	99,116.45
Princess	41,206.51	41,206.51
Rush No. 6	46,302.00	46,302.00
Rush No. 11	53,709.00	53,709.00
Winslow No. 1	9,397.30	9,397.30
Total	249,731.26	249,731.26

CLINTON (A. I. & M. Co's No. 8.)

Head office, Ashland.

Transportation, C. & O. railroad.

Owned by the Ashland Iron & Mining Co. (See Rush, No. 6.)

Operated by John Wurts, lessee.

This mine was inspected twice in 1901, and twice in 1902.

1901.—The report of last inspection, made August 8th by C. W. Logan, is: "No alarmingly bad conditions were discovered anywhere."

1902.—Inspected July 14th. A. G. S.—The ventilation of the mine was very unsatisfactory. Natural ventilation was depended upon. Directions to provide proper ventilation, and that artificial means (either furnace or fan) should be used, were given.

1902.—Inspected November 15th. A. G. S.—Artificial means had been provided, but the mine was idle, hence furnaces were cold, and the quantity of air supplied when mine was running could not be ascertained. Stacks were needed to improve the furnaces on entries 9 and 10. The air-course leading to the furnace on entry 10 was nearly choked with ashes.

PRINCESS.

Mine P. O., Princess.

Head Office, Ashland.

Transportation by the C. & O. Railroad.

Operated by the Princess Land & Mining Co. Henry Heywood, President; C. H. Lang, Jr., Vice-President; E. W. Strack, Treasurer and General Manager; J. H. Drake, Secretary (Princess).

This mine was inspected twice in 1901 and twice in 1902.

1901.—The report of last inspection, made by C. W. Logan, August 5th, was as follows:

“Barely a legal adequacy in return air-volume of 7,160 cubic feet per minute to furnace was discovered. The present furnace is insufficient to produce adequate ventilation for the 70 inside employes. However, with the improvements made as discussed with Mr. Hennecke, by enlarging the throat and arch of furnace, no doubt an immediate air betterment will result. This must receive your active attention. Except as noted, conditions fairly good.”

1902.—Inspected July 14th. A. G. S.—Although 47 persons were employed in bank, the intake of air amounted to only 6,810 cubic feet. All the entries were too far ahead of the air, and so were the rooms in Kouns entry. On the Kouns entry (28 persons) a test made in a break-through where the air should be passing, there was not sufficient current to turn the anemometer. All rooms were up more than 60 feet, but they had no break-through, hence no ventilation. The entry-top being full of slips, and dangerous, notice was given to look carefully after the timbering of it. No measurement of air could be obtained on the Vickers entry, there being practically no current, although there should have been not less than 3,200 cubic feet. On the Childress entry, where there should have been 4,600 cubic feet of air, there was practically no ventilation. Some of the rooms were up 100 feet, and yet no break-throughs. There was practically no ventilation on the Davison entry or on the Lusk. On the latter, at

the point where the total current for the bank should be passing there was not enough to turn the anemometer.

1902.—Inspected November 15th. A. G. S.—Following the preceding inspection a new furnace was built, and, with the exception of the Kouns entry, the mine was found in fine condition as to ventilation. In regard to the Kouns entry, the report is: This entry is still ventilated by the old furnace and is separate and apart from the remainder of the mine. You must brattice up all the worked-out rooms in this entry. With this done, ventilation will be improved here. Drainage good, and no dangerous, untimbered top was noticed.

RUSH No. 6 MINE.

Mine P. O., Rush.

Head Office, Ashland.

Transportation by the C. & O. Railroad.

Operated by the Ashland Iron & Mining Co. (Formerly by the Ashland Coal & Iron Railway Co. Change was made December 31, 1901, the new company assuming all contracts and engagements of the A. C. & I. in respect to its mining and manufacturing business.) Officers are: Douglas Putnam, President; Kenny L. Butler, Vice-president; D. G. Putnam, General Manager; Geo. E. Duncan, Secretary and Treasurer; Orin Kelly, Superintendent of Mines; Samuel Seaton, Assistant Superintendent of Mines, and Rees Davis, Engineer. Wm. Fain is mine foreman at this mine.

This mine was inspected twice in 1901 and twice in 1902.

1901.—The last inspection was made August 6th by C. W. Logan. The report is: "Seventy persons were employed in this mine, pulling pillars and stumps. All essential conditions were satisfactory."

1902.—Inspected July 9th. A. G. S.—Report is: All work confined to drawing pillars and stumps, and conditions as good as could be expected considering class of operations. Since this work is extra-hazardous, however, every precaution should be taken to ensure safety for the men.

1902.—Inspected November 17th. A. G. S.—The report is: All operations in this mine are still confined to drawing stumps and pillars, and there are only two entries being worked. They are the Main and Farmer entries. All conditions are as good as could be expected, considering class of operations.

RUSH No. 11 MINE.

Mine P. O., Rush.

Head Office, Ashland.

Transportation by the C. & O. Railroad.

Operated by the Ashland Iron & Mining Co. (See Rush No. 6.)
Mine foreman, Arch Clutts.

This mine was opened in 1901. Ventilation is by furnace. All coal is mined by hand. No inspection was made in 1901.

1902.—Inspected July 9th. A. G. S.—It was found to be in defective condition as regards both ventilation and timbering. There was not enough air entering the mine for the number of men employed, and the entries were too far ahead of their air-courses.

1902.—Inspected again November 17th, and all conditions found satisfactory.

WINSLOW No. 1.

Mine P. O., Ashland.

Head Office, Ashland.

Owned by Ashland I. & M. Co. (See Rush No. 6.) Operated by John Wurts, lessee.

This mine was opened in 1902. It was inspected November 15th. At that date, fifteen persons were usually employed inside. The mine was idle on the day of inspection, hence no measurements of air could be made, but it was evident that the arrangements were not sufficient for adequate ventilation as the bank should develop and more men be employed. The furnace shaft was too shallow, and there was no stack on it. It was noted that props were too far from the faces of all rooms on the left side of Main entry, and that they were not set thick enough in room 2.

Breathitt County.

There is practically only one commercial mine in this county. the Jackson, though that mine consists of several drifts. During the first part of the year 1902 the mine was operated by the Jackson Coal Co. (producing 4,716 tons), and for a short time R. T. Davis ran one of the drifts (producing 470 tons), but the production of all parties conducting operations is consolidated, the total output (all miscellaneous) being 25,364.90 tons.

JACKSON MINE.

Mine P. O., Jackson.

General Offices, Lexington.

Transportation, L. & E. Railway.

Operated by the Kentucky Union Co. Arthur Cary, President (Lexington); A. S. Henry, Vice-president and General Manager (Jackson); George Copeland, Secretary and Treasurer (Lexington). Mine foreman, R. T. Davis.

Practically all the output of the mine for 1902 was machine-mined, the company having installed the machines during the year. The coal-cutting plant consists of one Norwalk compound compressor, rated to furnish 558 cubic feet of free air when running at 150 r. p. m., and seven Harrison "GGG" mining machines. During the year a 400-ton capacity shaker screen was installed.

1901.—This mine was not inspected in 1901. The reports concerning it for that year were:

For May 30th, G. W. Stone.—"Mine had been idle for a month, and a new mining plant was being installed. Expected to commence re-mining coal by 10th of June. No examination was made."

For October 18th, G. W. Stone.—"Mine visited and an inspection was unnecessary and none was made."

For January 14, 1902; G. W. Stone.—"The mine was visited and conditions inquired into, and as far as heard, were satisfactory. The works are very much scattered, the new works being four entries in one hill—not in very far. The old works in former

mine consist in drawing pillars. A general inspection not being deemed of any importance, none was made."

1902.—Inspected July 21st; A. G. S.—The mine was found in very defective condition. There was practically no air entering the bank. The furnace power was inadequate to properly ventilate the mine, which consists of three openings, Nos. 1, 2 and 3, but all connected. The furnace on No. 3 was designed to pull the air into No. 1, thence through No. 2 into No. 3. The furnace shaft was only 10 feet deep, with stack of 20 feet. Directions were given to provide adequate means for ventilation.

1902.—Inspected November 24; A. G. S.—Report is: On No. 2 entry the air did not reach the faces on account of the curtain being off the neck of the first room on the right. In all other respects the conditions of the mine were satisfactory.

Carter County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Lost Creek	2,205.97	484.00	36,751.52	39,441.49
Strait Creek	90.00	.....	38,845.50	38,935.50
Meadow Branch	3,417.00	107.00	6,221.00	9,745.00
Boghead	9,425.02	.....	3,888.58	13,313.60
Rush No. 10 .....	.....	.....	162,341.00	162,341.00
A., I. & M. Bailey 1.....	.....	.....	21,302.00	21,302.00
Total	15,137.99	591.00	269,349.60	285,078.59

BAILEY NO. 1.

Mine Office, Rush.

Head Office, Ashland.

Transportation by the C. & O. Railroad.

Operated by the Ashland Iron & Mining Co. (See Rush No. 6.)

Mine foreman, James Mayberry.

This mine was opened in 1902. It is about two miles north of Rush.

It was inspected November 17th, and found in excellent condition. Attention was called to the dangerous character of the roof of the mine, though no untimbered, dangerous top was noticed.

BOGHEAD MINE.

Mine P. O., Grayson.

Head Office, Riverton.

Transportation, E. Ky. Railway to C. & O. Railroad.

Operated by Kentucky Cannel Co. Sturgis G. Bates, Treasurer; John Wurts, Superintendent. Mine foreman, Jas. Petrey.

1901.—The last inspection was made by C. W. Logan, August 7th. The report is: "Ventilation not bad. Entries fairly well timbered. Roof in rooms fairly-well posted. Drainage not good, especially on main 7 and 9 entries, and the drain boxes near drift mouth must be opened at once, as talked with Mr. Wurts, superintendent."

1902.—Inspected July 12th; A. G. S.—The report is: This mine has three openings working, and each one is driven through to daylight, and natural means are depended on for ventilation. The ventilation is not bad, although, as a matter of course, the current does not always travel the same direction all the time. Each entry is supplied with a furnace, but no fire is kept in them. The drainage is very defective.

1902.—Inspected November 20th; A. G. S.—The report is: All conditions satisfactory.

LOST CREEK MINE.

Mine Office, Willard.

Head Office, Riverton.

Transportation, E. Ky. Railway to C. & O. Railroad.

Operated by Mine Department of Eastern Kentucky Railway. Nathaniel Thayer, President (Boston); S. G. Bates, Vice-president; John Wurts, Superintendent of Mines. Mine foreman, A. C. Morris.

This mine was visited once and inspected once in 1901. It was inspected twice in 1902.

1901.—The 1901 inspection was made by C. W. Logan, August 10th. The report is: "Excepting some entry faces being more than the legal distance (60 feet) ahead of air, ventilation is not bad. Furnace doors must be carefully kept closed, as instructed Mr. Duncan, mine boss, to allow the furnace sufficient draught power."

1902.—Inspected July 11th; A. G. S.—Drainage was found to be excellent, and timbering good, but ventilation quite defective. There was not enough air entering the bank, and what did enter was not carried to the faces, the entries being too far ahead of the air. On entries 6 and 8 (25 persons in one and 28 in the other) the current was too weak to turn the anemometer. On entry 7 a volume of 9,127 cubic feet, being a sufficient current, was traveling, but it didn't reach the working faces.

1902.—Again inspected November 19th; A. G. S.—Again the ventilation was found defective. It seemed that a larger furnace was required. The air-shaft is 27 feet deep, on which was a "stack" only 3 feet high. On entry 6 there were 2,952 feet of air, enough for the 18 persons there, but on entries 8 and 7 the current was too weak to turn the anemometer.

MEADOW BRANCH MINE.

Mine P. O., Rush.

Head Office, Mt. Sterling.

Transportation C. & O. Railroad.

Operated by the Adkins Coal Co. J. F. Vansant, President; James W. Groves, Secretary and Treasurer; G. H. Strother, Superintendent.

Among improvements contemplated for 1903 is an additional tramway.

The mine was inspected twice in 1901—in January and in August—and twice in 1902.

1901.—The last inspection was made by C. W. Logan, August 7th. The report is: "This is a new mine. Main entry face in about 150 feet. Twelve men employed inside. Natural means is the dependence for ventilation. However, the first left room is an admirable location for an effective furnace, which must be built at once. I trust you will give this matter your active, immediate attention and obviate the necessity for further complaint. Conditions otherwise good as expected."

1902.—Inspected July 10th; A. G. S.—The report is: "The mine has been neglected so long that the conditions are very bad. The ventilation and timbering are very defective indeed, and the drainage is miserable on the Main entry." No measurement of air could be obtained on the Main entry, where not less than 1,900 or 2,000 cubic feet should have been traveling; the workings on 1st Left had no ventilation, and only 890 cubic feet were passing through the furnace.

1902.—Inspected November 18th; A. G. S.—The report in full is: Notwithstanding the fact the mine was in operation, and 20 men employed inside, there was no fire in the furnace. Hence I was unable to correctly determine the amount of air passing into the bank. Upon examination of your furnace, however, I am led to believe that it is totally inadequate to properly ventilate your mine. It is entirely too small. Your air-shaft is also too small, and your stack is not high enough. If there was sufficient air passing into and traversing the mine, it would reach the faces. Props are too far from the face of each room in your mine. You must look after this matter more carefully.

RUSH No. 10.

Mine Office, Rush.

Head Office, Ashland.

Transportation by the C. & O. Railroad.

Operated by the Ashland Iron & Mining Co. (See Rush No. 6.)

Mine foreman, Geo. Hammonds.

Ventilation is by furnace. The coal is mined by hand and by machine, principally by hand.

Although this company has ten coal-cutting machines, only about 10.4 per cent. of its total output (or 29,705 tons out of a production of 283,654 tons) was machine-mined. The coal-cutting plant consists of the following: One Ingersoll-Sergeant 10-machine, single stage compressor; one Norwalk triple stage (to 800 lbs.) compressor; four Harrison, four Ingersoll-Sergeant and two Sullivan punchers, each of 5-foot undercut. For haulage are used one 13-ton H. K. Porter compressed air locomotive and one 11-ton Baldwin locomotive.

The mine was inspected twice in 1901 and twice in 1902.

1901.—The last inspection was made by C. W. Logan, August 7th. The report is: "Ventilation in 1st Right entry workings will be improved by hanging a door on 1st Right below furnace, thereby necessitating the abstraction of entire air-intake from Gilbert entry side. Excepting the above-mentioned deficiency, air conditions satisfactory. No neglect to post rooms or timber entries observed. Drainage good."

1902.—Inspected July 10th; A. G. S.—While the volume of air passing into the mine was ample for the 138 persons employed inside, it was not properly conducted to the working faces. The mine was too wet in several places, and the timbering was defective in some places.

1902.—Again inspected November 18th; A. G. S.—All conditions were satisfactory.

STRAIT CREEK MINE.

Mine P. O., Denton.

Head Office, Mt. Sterling.

Transportation, C. & O. Railroad.

Operated by the Strait Creek Coal Co. M. M. Cassidy, President; W. T. Tibbs, Secretary; Kenton Prichard, Superintendent of Mines. Mine foreman, R. R. Stamper.

The mine was inspected in February and August in 1901, and twice in 1902.

1901.—The last inspection was made by C. W. Logan, August 9th. The report is: "All work is coming back and general conditions are reasonably good, all things considered."

1902.—Inspected July 11th; A. G. S.—An ample amount of air was entering the bank, but it was not going to the working faces. Entries were too far ahead of the air, and rear break-throughs were open. On 1st Right entry there was practically no current. Drainage was bad.

1902.—Inspected November 19th; A. G. S.—The report is: Ventilation and timbering satisfactory, and drainage very much improved since my former inspection.

Johnson County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Whitehouse	9,337.75	1,738.00	42,435.00	53,510.75
Greasy Creek Co.	1,598.60	.....	3,482.05	5,080.65
Sandy River Co.	371.15	.....	443.85	815.00
Total	11,307.50	1,738.00	46,360.90	59,406.40

GREASY CREEK MINES.

Mine Office, Eliza.

Head Office, Chicago, Ill.

Transportation, Big Sandy Division C. & O. Railroad.

Operated part of year by Greasy Creek Cannel Coal & Tramway Co., which was succeeded by the Sandy River Coal Co. F. A. Stacy, President (Chillicothe, O.); J. P. Dieter, Secretary and

Treasurer (60 Waldo Place, Chicago, Ill.); J. W. Frymier, Superintendent of Mines. Mine foreman, James Williams.

Comparatively little was done at these mines during 1902—practically nothing in the way of mining after July 1st, on account of lack of facilities for making shipments, the tramway having been rendered unserviceable pending the building of the C. & O. Railroad up the Sandy.

The mine was inspected twice in 1901. In 1902 it was inspected once and visited once without inspection.

1901.—The last inspection was made by C. W. Logan, August 13th. The report is: "Ventilation insufficient, but 2d West entry will go to the outside in about 50 feet and be utilized as an air intake way, which will materially aid the furnace and increase the return air volume of 6,720 cubic feet per minute air-volume, as at present, to an abundant sufficiency. Conditions in other respects good."

1902.—Inspected July 16th; A. G. S.—The report is: The mine was idle; no fire in the furnace, consequently I could not determine the volume of air passing into the mine. All the entries are ahead of the air. When the mine resumes business, the entries should not be driven any further till the air-courses are up with them. The top on the Ed. Preston entry must be scaled.

1902.—On November 15th the mine was visited, but not inspected, because it had been idle since the last inspection.

This mine was now controlled by the new company (Sandy River Coal Co.), and that company had opened up the old Sandy River mine, about one-fourth mile from the main opening of this bank, and had laid a track of 25-pound steel rails to it.

WHITEHOUSE MINE.

Mine Office, Whitehouse.

Head Office, Louisa.

Transportation, Big Sandy Division C. & O. Railroad.

Operated by the Whitehouse Cannel Coal Co. Dr. Harry A. Wood, President (Amsterdam, N. Y.); Col. Jay H. Northup, Gen-

eral Superintendent and Treasurer; F. D. Wallace, Secretary; George Bickford, Superintendent at Mines. Mine foreman, Bert Price.

The company is making connections with another seam of coal, with the expectation that by February 18, 1903, mining will be carried on in two seams and the output thereafter be materially increased.

The mine No. 3 was inspected once and visited without inspection in 1901.

1901.—The report of visit of August 13th, by C. W. Logan, is as follows: This mine is finishing up with nine men inside, preparatory to starting up the new mine on Whitehouse creek, which is fully equipped for running; but as yet only two men are at work inside. Didn't inspect either of these mines under the circumstances. Mr. Bickford, superintendent, informed me that in the near future active operations would begin at the new mine.

1902.—Inspected July 17th; A. G. S.—There were three distinct openings, each one being aired separately. On No. 1 all work was confined to drawing stumps and pillars. The entry was driven through to daylight, and conditions were very good, considering the class of operations. In No. 2 entry 20 persons were employed. Although there was a furnace for the entry, the foreman admitted that there was never any fire in it—that natural means were depended upon entirely. Ventilation was very defective—not enough current to get a measurement—and room faces were too far ahead of break-throughs. No. 3 entry was driven through to daylight. Ventilation was unsatisfactory.

1902.—Again inspected November 13th; A. G. S.—All conditions satisfactory.

Lawrence County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Peach Orchard (2)	26,693.00	2,202.00	21,216.00	50,512.00
Torchlight	1,750.00	528.00	1,508.00	3,786.00
Total	28,443.00	2,730.00	23,125.00	54,298.00

PEACH ORCHARD MINES.

Mine Office, Peach Orchard.

Head Office, Canton, O.

Transportation, Big Sandy Division C. & O. Railroad.

Operated by the Peach Orchard Coal Co. John C. Welty, President (Canton, O.); H. P. Scott, Secretary (Canton, O.); O. P. Chatfield, General Manager at mines; J. P. Small, Mine Superintendent. Mine foremen are: M. Williamson, at the Anna mine; David Spence, at the Elizabeth No. 2.

The company has nine Harrison and two Jeffrey-Legg mining machines, but only about 16.5 per cent. of its 1902 output was machine-mined.

There are two mines here, known as the Anna and the Elizabeth No. 2 (or new mine). The mines were visited twice in 1901—the Anna inspected twice and Elizabeth No. 2 once. Both mines were inspected twice in 1902.

1901.—Mr. Logan's report of his last trip, August 12th, is as follows: The Anna.—“Sixteen thousand five hundred and eighty (16,580) cubic feet air per minute returning to the furnace, for the 60 persons, and fairly-well conducted to immediate working faces. Drainage, propping and timbering satisfactory.”

New mine (Elizabeth No. 2).—"No one was in or about it, as it has not run for several weeks. Hence, no inspection."

1902.—Both mines inspected July 15th; A. G. S.:

Anna Mine.—There were 47 persons in bank. Ventilation and drainage were both defective. Entries were allowed to get beyond their air-courses, and there was not enough attention paid to mud and water. The 12th Right and 10th Left entries had practically no ventilation, and in the 12th Left, where the total current for the bank should have been passing, only 1,731 cubic feet could be measured.

Elizabeth No. 2.—There were 22 persons in bank, but there was practically no ventilation—not enough current at the intake to turn the anemometer. Entry faces, moreover, were too far ahead of the air had there been a satisfactory current.

1902.—Again inspected November 12th; A. G. S.:

Anna Mine.—Although the ventilation and drainage had been improved since the former inspection, they were not yet satisfactory. With 45 persons in bank, only 3,844 feet of air could be measured on 12th Right entry, where the total current should have been traveling. In the 12th Left and 10th Left the current was entirely too weak. It was noted that the tendency was to drive room-faces beyond the legal distance (60 feet) before making break-throughs.

Elizabeth No. 2.—Except in the matter of break-throughs between two rooms, the mine was in excellent condition.

TORCHLIGHT MINES.

Mine Office, Torchlight.

Head Office, Louisa.

Transportation, Big Sandy Division C. & O. Railroad.

Operated by the Torchlight Coal Co. W. H. Rowe, Jr., President (New York); R. F. Vincent, Vice-president; Col. Jay H. Northup, General Superintendent and Treasurer; J. M. Wallace, Superintendent at mines. Mine foreman, Lafayette Vermillion.

The output for 1902 was all mined by hand. The company has purchased six Sullivan mining machines and a 15-machine

(22 x 24) Sullivan compressor, however, and it is probable that the total output for 1903 will be machine-mined.

This mine was not inspected in 1901. In February, when Mr. Logan was in the region, it was not running.

1902—Inspected July 15th; A. G. S.—The report is: The ventilation and timbering in this mine has been neglected so long that the conditions are very bad. In the first place, the furnace power is inadequate to ventilate the bank. In the next place, the timbering is defective, and the drainage far from good. The Main entry was the only one working. Insufficient air was supplied it. There were no props in any of the rooms. A dangerous piece of top on the entry needed pulling down.

1902.—Again inspected November 14th. The mine had been put in excellent condition.

Lee County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellane's	Total
Norman & Sons	16,122.00	5,447.00	.....	21,569.00
McGuire	5,163.00	510.00	3,104.00	8,777.00
Total	21,285.00	5,957.00	3,104.00	30,346.00

McGUIRE MINE.

Mine Office, Beattyville.

Head Office, Beattyville.

Transportation, L. & E. Railway.

Operated by the McGuire Coal Co. Walker Jameson, President; Logan Thomas, Secretary and Treasurer. Mine foreman, Thomas Jameson.

The mine was inspected twice in 1901 and twice in 1902.

1901.—The last inspection was made by G. W. Stone, October 19th. The report is: "The mine was inspected and found to be in excellent condition."

1902.—Inspected July 18th; A. G. S.—There was not enough air passing into the mine for the 24 persons in bank, and what there was was not well conducted. Entries were ahead of the air, four rooms were without necessary curtains, and other curtains were in poor condition.

1902.—Inspected November 21st; A. G. S.—The ventilation had been much improved, but was still defective in the 4th Left and 4th Right entries. An ample amount of air (5,904 feet) was entering for the 29 persons in bank, but it did not reach the working faces on the entries named.

WHITE ASH MINE.

Mine Office, Beattyville.

Head Office, Lexington.

Transportation, L. & E. Railway.

Operated by L. C. Norman & Sons. L. C. Norman, President (Lexington); John C. Richardson, Secretary (Lexington); Attila Norman, General Manager (Beattyville).

The mine was inspected once in 1901 and visited once without inspection. It was inspected twice in 1902.

1901.—Visited by G. W. Stone, October 19th. The report is: "Mine had been idle for almost two months, waiting for the completion of the railroad, and no inspection was made."

1902.—Inspected July 18th; A. G. S.—An ample volume of air (5,454 feet) was entering for the 37 persons in bank, but it was not properly conducted to the working faces. Rooms were being systematically driven 150 feet with only one break-through, and that one at only 20 feet from the entry. On the 1st Left entry, where the total air should have traveled, the current was too weak to turn the anemometer. On the 2d Left and on the 3d Right there was practically no ventilation. Props were too far from room faces in both the 1st Left and 2d Left entries.

1902.—Again inspected November 21st; A. G. S.—Ventilation and drainage had been improved somewhat, but in some portions of the bank conditions were still defective. Sufficient air was entering, but it was not going to all the working faces. Props were not kept close enough to room faces. Attention was urgently called to this, and warning given that unless greater care is exercised with respect to it, serious accidents from falls of top are liable to occur.

Morgan County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Caney	9,153.00	678.00	3,848.00	13,679.00
Kentucky Block	19,688.50	.....	7,311.52	27,000.02
Total	28,841.50	678.00	11,159.52	40,679.02

CANEY CANNEL MINE.

Mine Office, Biggstaff.

Head Office, Mt. Sterling.

Transportation, Ohio & Kentucky and Lexington & Eastern railways.

Operated by Biggstaff Cannel Coal Co. (successor to Caney Cannel Coal Co.). J. M. Biggstaff, President; M. O. Cockrill, Treasurer; C. M. Keyser, Secretary (Biggstaff). Mine foreman, D. J. Stamps.

The mine was inspected twice by Mr. G. W. Stone—once in 1901 and once in 1902—and twice in 1902 by Mr. Spillman.

1901.—For October 17th, Mr. G. W. Stone reports: "The mine was in the hill only about 75 feet, and was inspected and found to be in good condition."

1902.—For January 13th, Mr. G. W. Stone reports: "The mine was fully inspected in all its parts and found to be in splendid condition in all respects. Eighteen men are employed inside the mine."

1902.—Inspected July 19th; A. G. S.—An ample volume of air was entering the mine for the 27 persons in bank, but it was not well conducted. On the Main entry, right side, three rooms were working, but had no ventilation. Break-throughs and doors were needed on the Main entry work and on the 1st Left work. Drainage and timbering were satisfactory. At the date of this inspection the Biggstaff Company had had control but a short time.

1902.—Inspected November 24th; A. G. S.—All conditions were satisfactory.

KENTUCKY BLOCK CANNEL MINE.

Mine Office, Cannel City.

Head Office, New York, N. Y.

Transportation, Ohio & Kentucky and Lexington & Eastern railways.

Operated by the Kentucky Block Cannel Coal Co. W. De L. Walbridge, President (No. 1 Broadway, New York City); M. Baxter, Jr., Secretary and Treasurer (No. 1 Broadway, New York City); M. L. Conley, Superintendent, and H. H. Hager, Cashier, both at Cannel City. Mine foreman, Herry Vaughn.

All the output for 1902 was mined by hand. The company has installed a compound Norwalk (22 x 24) compressor, with twelve Harrison mining machines, class "W," with a view to mining entirely with machines.

This mine was visited in 1901, but not inspected. It was inspected twice in 1902.

1901.—For October 17th, Mr. G. W. Stone reports: "Mine was visited. An inspection was not deemed necessary, and none was made."

1902.—For January 13th, Mr. G. W. Stone reports: "Repairs were being made of Kentucky Block Cannel Co.'s mine, and no inspection deemed of any value and none was made."

1902.—Inspected July 19th; A. G. S.—The mine has two openings, known as No. 2 and No. 3. Ventilation and timbering were defective in each. At the date of this inspection, the Superintendent, Mr. M. L. Conley, had been in charge but a short time.

1902.—Inspected November 22d; A. G. S.—Ventilation, drainage and timbering were all satisfactory.

SOUTHEASTERN DISTRICT.

The following counties, producing commercial coal in 1902, lie within this district: Bell, Knox, Laurel, Pulaski and Whitley.

Output of bituminous coal in 1902, in tons.....	2,032,008
Output of cannel coal in 1902, in tons.....	8,192
Total tons shipped from the mines.....	1,895,043
Production of coke in 1902, in tons.....	51,829
Employees for 1902: Maximum, 4,609; average.....	4,323
Average number of days worked in 1902.....	219

Bell County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Black Raven	26,356.00	3,686.00	12,377.00	42,419.00
Bennett's Fork .....	.....	.....	20,198.85	20,198.85
Pineville	30,282.95	.....	47,985.09	78,268.04
Excelsior .....	.....	.....	49,043.90	49,043.90
Straight Creek .....	.....	.....	188,094.25	188,094.25
Tuckehoe	733.00	443.00	729.00	1,905.00
Total	57,371.95	4,129.00	318,428.09	379,929.04

BLACK RAVEN MINE.

Mine Office, Fourmile.

Head Office, Chicago, Ill.

Transportation, C. V. Branch of Louisville & Nashville Railroad.

Operated by the Black Raven Coal Co. M. Goldsmith, President (63 Washington street, Chicago); S. Goldsmith, Secretary and Treasurer (Chicago); B. Tatarian, Manager and Superintendent (Fourmile). Mine foreman, John Gorman.

This mine was opened in 1901. First shipments were made in August of that year.

The mine is ventilated by an 8-foot Fair fan, installed in 1901. Practically all the output for 1902 (95 per cent. of it) was machine-mined. The plant includes a McEwen engine of 165 h. p.; a Jeffrey 100 k. w. generator, and seven Jeffrey low vein mining machines. The boiler is rated at 150 h. p.

1901.—Inspected September 17th by C. W. Logan. Report is: "This is a new mine, electrically equipped, with 30 operatives, working on 1st, 2d, 3d and 4th entries; also Main entry is being driven. First coal output in August. Essential underground conditions are fairly good."

1902.—Inspected June 25th; A. G. S.—All conditions satisfactory.

1902.—Inspected October 6th; A. G. S.—Ventilation was defective in that, although an ample quantity of air was entering the bank, it did not reach all of the working places. For the working places on Second Right entry there was not sufficient current to turn the anemometer. It was observed that entries were turned off every 250 feet, with rooms broken off each and driven so as to meet half way (making each room 125 feet deep), and yet no break-throughs were made between rooms. Attention was called to this violation of the law.

1902.—Inspected December 4th; A. G. S.—An ample quantity of air was entering the bank, but some rear break-throughs were

open, and the current did not ventilate some of the working places as thoroughly as should have been the case. Break-throughs were needed between rooms 2 and 4 and 4 and 6 on 4th Right entry; between 24 and 26, and 26 and 28 on 2d Right, and between 36 and 38, and 38 and 40 on 1st Right. In some instances break-throughs were made too narrow. Attention was called to a dangerous practice with respect to rooms, as follows: "You are driving your rooms very irregular in width. Some of them are 60 feet wide and some are wider. This pillar between room 2 and room 4 [1st Right] is only 2 feet wide in one place. This is a very dangerous practice, as it will bring a creep and cause you to lose your mine."

BENNETT'S FORK.

Mine Office, Middlesboro.

Head Office, Middlesboro.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by Bennett's Fork Coal & Coke Co. George Luke, President; E. Luke, Treasurer; Hugh Drummond, General Manager.

The mine was inspected twice in 1901 and three times in 1902.

1901.—The last inspection was made September 19th by C. W. Logan. The report is: "Excepting a check-curtain needed on 3d Right entry to ventilate same, air conditions were satisfactory. Drainage not very good. Rooms were well posted. Entries were satisfactorily timbered."

1902.—Inspected June 21st; A. G. S.—The mine was idle, and furnace cold, hence determinations of air volumes could not be made. Conditions throughout the bank showed, however, that with the furnace supplying an adequate current, the air would properly ventilate the working places, except in the 3d Right entry, where a rear break-through needed to be closed.

1902.—Inspected October 2d; A. G. S.—Ventilation was defective; practically no current in the main intake where the total

volume for the bank shot d have been traveling, though 2,555 feet were going through the furnace. Seven rooms on 4th Right entry needed break-throughs. The Main entry was allowed to remain too muddy.

1902.—Inspected November 27th; A. G. S.—The air-current was again found to be short. In brief, although there was enough air passing through the furnace to supply the bank, the working places were practically without ventilation.

The company is in the hands of a receiver.

EXCELSIOR MINE.

Mine Office, Excelsior.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by Excelsior Coal Mining Co.; H. Ingles, Treasurer.

The mine was inspected twice in 1901 and thrice in 1902.

1901.—The last inspection was made by C. W. Logan, September 18th. The report is: "Owing to broken anemometer, the draught power of furnace recently built could not be obtained. However, with break-throughs made in rooms as indicated to Mr. Fisher, ventilation ought to be reasonably fair, for the 160 persons employed inside. Drainage in workings fairly good, but Main entry needed better drainage by opening up ditch near drift-mouth and changing lieaway further up Main entry, as discussed with mine boss. Roof well supported."

1902.—Inspected June 21st; A. G. S.—Ventilation and timbering were satisfactory. Drainage on the Main entry was very bad.

1902.—Inspected October 2d; A. G. S.—Ventilation and timbering were satisfactory. Drainage of the Main entry had been improved, but there was still too much water allowed to stand on the Main entry.

1902.—Inspected November 28th; A. G. S.—The ventilating current did not reach the faces of rooms on 8th entry, because of lack of break-throughs. In all other respects the mine was in a satisfactory condition.

PINEVILLE MINES.

Main Office, Wallsend.

Head Office, Wallsend.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by Pineville Coal Co. Chas. E. Hall, President; P. C. Kelleher, Secretary; Reno Short, Superintendent. Mine foremen are: Jesse Broughton, at Nos. 1 and 3; John Martin, at No. 2.

Two seams are worked, namely, the Pineville, having a thickness of 30 inches, and the Meynier, having a thickness of 54 inches. Two openings—Nos. 1 and 3—are in the Pineville seam, and one—No. 2—in the upper coal.

The three mines are each supplied with an 8-foot Fair ventilating fan (installed in 1901), two of them operated by 8 x 8 steam engines, and one of them by a 15 h. p. electric motor. The speed may be adjusted to the requirements of the mine up to 250 r. p. m. In No. 1 mine trains are hauled by an 8-ton Link-Belt 35-h. p. electric locomotive. In November, 1902, two electric chain breast coal cutters were in use, one of them a Morgan-Gardner, with 45-inch cutter-head, having an approximate daily capacity of 60 tons; the other a Link-Belt, with 36-inch cutter-head, having a daily capacity of almost 60 tons. The undercut in each case is 5 feet. Under date of November 29th, the company wrote that it expected to soon install the following: A 24-ton Goodman electric locomotive for room gathering in Nos. 1 and 3 mines; also a Goodman electric chain machine, with 45-inch cutter-head, 6-foot undercut, having a capacity of about 75 tons per day, and a Jeffrey chain breast machine, with 45-inch cutter-head, 6-foot undercut, and approximate capacity of 75 tons per day. This plant was to be located at mines 1 and 3. Fifty additional dwellings for miners are being built.

No. 1 mine was inspected four times in 1901 and three times in 1902. No. 2 mine was inspected three times and visited without inspection (idle) once in 1901, and inspected three times in 1902. No. 3 mine seems not to have been operating in 1901; it was in-

spected three times in 1902. On account of the difficulties that have attended the getting of No. 1 mine into good condition, all notices served in 1901 are given, as well as extracts from those served in 1902.

NO. 1 MINE.

1901.—Inspected April 11th by C. W. Logan. The notice is: "A very dangerous piece of slate on 6th Left entry was directed pulled; 15,240 cubic feet of air per minute was returning to the furnace, which was fairly-well distributed to the working places of 85 inside workmen, though many air leaks in curtains was called to the attention of mine boss, with instructions to repair same. Drainage good."

No. 1, 1901.—Again inspected by Mr. Logan, June 10th. The notice is: "Thirteen thousand three hundred (13,300) cubic feet air per minute was returning to the furnace, which was supposed to ventilate the 100 inside workmen, but very little air-current was carried near head entry workings, owing principally to lack of check-curtains. Quite an important air leakage in brattice was ordered stopped on Main entry near 6th Left. Main 1st entry should be driven outside, not only to aid ventilation and drainage, but also to provide the 2d outlet, as 3d Right entry no longer can be used as such. Much loose slate needed pulling on 5th Left entry between Main 1st and 2d."

No. 1, 1901.—Again inspected by Mr. Logan, September 13th. The notice is: "Very secure timbering must be done on 1st Main and 5th Left entries. Most careful attention must be accorded 5th Left entry, especially between 1st and 2d Main entries. This roof is very much disturbed and requires strict attention, and it is probable that this condition will furnish an object lesson, in so far as turning rooms 30 or 40 feet wide from air-way side is concerned. A new fan has recently been installed, which, under the circumstances, is sending a good air-volume into the mine, though the throat (mouth of old furnace) needs enlarging, as instructed mine boss. On account of a serious squeeze from 2d

to 5th Left entry the air-way is practically closed, and the current that reaches head of workings, which is very little, necessarily makes its way over falls, etc., which naturally reduces its volume or strength. Owing to this alarming inadequacy of ventilation, it is deemed expedient to insist that 6th Right, off 2d Main, be hurriedly driven to connect with 1st Main, and with the connection of 1st right off 2d Left with 5th Left workings, a complete clear air-way to all workings will result, with return current via 2d Main, 6th Right and 1st Main entries, as discussed with management. This mine at present has no second way of ingress and egress, as required by section 9, State Mining Law. Fifth Right entry driven to outside will provide the required second outlet, which is absolutely and immediately essential; also an advantage in regard to drainage would result, which would be greatly assisted by the drain ditch near slope bottom being reopened. This deficiency in regard to second outlet and inadequacy of ventilation, places this mine condition clearly in violation of sections 3, 9 and 10 of the State Mining Law. Hence, forty (40) days are allowed in which to remedy the above-mentioned defects. The Inspector participated in a convention relative to this subject with the President of this company, and it is gratifying to know that the assurances given by said President that the condition of the mine would be improved as speedily as possible, would be carefully carried out in full compliance with the law."

No. 1, 1901.—Again inspected by Mr. Logan, November 13th. The notice is: "Fifth (5th) Right entry is driven outside and is draining the mine nicely. The instructions given formerly in inspection notice No. 223, of September 13th, are being complied with, but, owing to lack of settlement with miners, very little work was done in September, and not much improvement in ventilation was noted. However, the squeeze on Main 1st entry seems to have settled to a great degree, and drainage is materially improved; also some very needed timbering has been done on Main 1st and 5th Left entries. Mr. Broughton, mine boss, assured me

that my former instructions would be fully complied with, just as soon as the necessary excavations could possibly be made."

No. 1 Mine, 1902.—Inspected June 24th; A. G. S.—The report, in part, is: On account of the squeeze between 2d Left and 5th Left entries, there is no air entering the working places beyond 2d Left. This is in constant violation of the mining law. There must be not less than 100 cubic feet of air per minute passing into the mine for each person employed inside, and it must be kept within 60 feet or less of the working faces, and must also be sent through the rooms. If you can not get the air into the working places at once, you must stop the 2d Left entry, take the men out, send the air up the Main entry to 5th Left, and then it will reach the diggers." "Instead of driving through the fall on 3d and 4th Left entries, it would be far better to go 80 or 100 feet (100 feet would be better) beyond the fall and drive through the solid coal. This would give you an opening that would be permanent; while, if you drive your air-course through the fall, it will only be a matter of a short time till it will fill up again. I inclose you three rough sketches drawn by the Chief Inspector, showing you how you can air your mine by sending the air into 2d Left and then bringing it back to the Main entry and up the Main to 5th Left."

Following are extracts from correspondence which followed service of the foregoing notice:

(a) Pineville Coal Co., by P. C. Kelleher, Secretary, to Assistant Inspector, July 17th.—"We have your report on our mines, dated July 1st, Nos. 93, 94 and 95. The only one that seems to demand special attention is your report on our No. 1 mine (No. 93). Would say in reference to the same that we are doing everything in our power to improve the conditions in 2d Left and 5th Left. Would say to you, however, that since we have got the water down in 2d Left that the air is very much improved indeed. Our mine boss, Mr. Broughton, understands your views about the matter, and will do everything in his power to try and carry out your views for the good of the mine and the comfort of the

men employed in it. We will ask you to be a little patient with us, for the reason that we can not do everything in a day, and as quick as we can run the entry through between 5th and 2d Left we will then be able to provide a full and proper supply of air. We are running the new Main, as you will understand, out to the crop. Meantime Mr. Broughton is at work plastering up in No. 2 so as to convey as much air as possible."

(b) From letter of Chief Inspector to Pineville Coal Co., July 19th.—"I have your letter of July 17th, addressed to Mr. A. G. Spillman, Assistant Inspector. . . . I can not just make out from your letter whether you are still working your 2d Left entry, and expect to continue doing so until you can make connection with the 5th Left by means of a way through the fallen ground between said entries, or not. I beg to say, however, that I trust you will not fail to give due heed to the requirements of said notice, and have the mine in lawful condition within the limits allowed by law."

(c) From reply to foregoing by Pineville Coal Co., P. C. Kelleher, Secretary, July 22d.—"We have your favor of the 19th relative to our No. 1 opening. We believe that you misunderstand the situation regarding this mine to a great extent, also that Mr. Spillman did not acquire all the data necessary to arrive at a conclusion regarding the best and quickest way to thoroughly secure ventilation in this mine. Would say we are carrying regular air-courses along with our entry, and have been doing so since last fall, at which time we commenced a series of steps looking toward opening up entirely new works to the rear of those we then had. It seems that in the past there were no regular air-ways, the rooms were widened off the air-course and breakthroughs made between the rooms, the stumps and pillars were not sufficient, and therefore all the works from No. 2 to 5 Left have fallen in. Last fall we commenced to drive a cross-cut entry to the rear of these works to serve as a new haul-way, and intending to continue on from this cross-cut entries 3 and 4. We have this entry driven through between 2 and 5 Left, except about

300 feet; we are driving this entry now from the 5 side as well as from 2 Left, and inside of two months it will be driven through. This will solve the entire air question, for then the air that goes up No. 2 Left, where it has to go through the entry, since there is no air-course, can return by this cross-cut entry over to 5 Left, and thence to 2d Main and around the group of entries there, returning through the original Main entry. It would be impossible to start any air-course through the fallen-in territory between 2 and 5; the air that now goes up 2 Left returns and percolates through the fallen works and works its way up to 5 and the works in that direction, also along the cross-cut where we are driving the entry through. In this way only can we send air up to 5 until we cut through the remaining 300 feet in the cross-cut entry between 2 and 5. It would be making things no better to shut off 2 Left and send the air up the Main to 5; all on the right of the Main is gob, and the miners in the 5 Left region would fare no better than now. Would say, however, that recently we have been pumping out a large pile of water which had collected in 2 Left from the fallen territory, and that it is pumped to the level of the rail at the lowest point. This gives the air a better chance, and our reports are that it is decidedly better. We are also running the fan an extra number of hours and putting it to its best speed; in fact there are no real grounds at the present time for complaint about the air, and when you consider that it is only a matter of about two months when this cross-cut entry will connect 2 and 5, along which there is a good air-course, you will readily see that we can not devise any plan to improve the air quicker than that of cutting through this cross-cut entry. Should we adopt any other plan of daubing the Main and shutting off 2, the time wasted and the expense would be more than the returns.. . . We are spending a lot of money trying to put this mine in shape; we are anxious to comply with the wishes of your office in every regard; we only ask you, and we know that we will receive this at your hands, that you treat us with the consideration which our efforts deserve in trying to make this a mine

strictly within the letter and spirit of the law. We have spent a large sum of money during the past year driving every foot of entry we could, with the ultimate intention of being entirely free from and away from the fallen-in territory to the right and to the left of the Main entry."

From the foregoing letter it was seen that the company was doing precisely what had been suggested by the Assistant Inspector in regard to making a connection between 2d Left and 5th Left; that it was not attempting to open a way through the fallen ground, as the Chief Inspector had understood to be the case, but was heading off the fallen ground, and was driving through solid coal. It seems, in fact, that the company was carrying out the instructions given by Assistant Inspector Logan, September 13, 1901. The correctness of the plan the company was following was recognized, and it was approved. Not wishing to throw men out of work, and bearing in mind the fact that it was generally understood by all that the ventilation could not well be improved until the cross-cut between entries 2 and 5 could be put through, hence that it was a matter of choice for any one to work in the mine under such circumstances, it was not deemed necessary to enjoin the company from working more than five in the mine until the cross-cut could be completed. It was urged upon the company, however, that it should adopt every possible means to rush the cross-cut through, and it was suggested that, if practicable, a double shift should be put on each end. In response, the following statement was received from the company:

(d) From Pineville Coal Co., Chas. E. Hall, President, August 14th.—"I have personally conferred with the miners in session at their Local, and they all agree with me that there is no practical method of changing the air in No. 1 mine except by the cross entry, and they are making—i. e., the men—every concession to the miners engaged in driving this entry from both ends as they realize the necessity of completing this work as a remedy of the air question. We are only being restricted in our efforts to finish

this entry by the possibility of the men working in it on account of the smoke. We are driving it 'tight' and keeping the slate away from them constantly and giving them every opportunity to shoot whenever it may be necessary. The conditions will not permit, in the opinion of the men, their working in this entry a longer number of hours than they are at present working. While Mr. Kelleher, in his letter of July 22d, anticipated 60 days to complete this entry, I would say that provided we can drive the air 60 or 100 feet ahead of the entry and from each direction, you will see that in the course of 30 days, or a trifle more, we should have the air-courses in this entry connected."

On October 4th, the mine was again inspected. The cross-cut was not yet through, hence no improvement in the ventilation. It was then expected that it surely would be completed by November 1st. On November 29th, however, when the mine was again inspected, the cross-cut was still not through. The connection was made in the early part of December.

NO. 2 MINE.

1901.—Last inspection was made by C. W. Logan, November 13th. The report is: "Twenty-eight thousand five hundred (28,500) cubic feet air per minute entering the mine to ventilate the 80 persons employed therein, and with curtains repaired and doors substituted in many places, where indicated mine boss, its conduction to working places would be reasonably good. However, certain connections are almost made that will allow 1st Right Cross off 6th Left entry adequate ventilation, whereas at present it is inadequately ventilated. Air-way near intake mouth needs clearing out and timbering immediately. Drainage improved, but still needs attention, especially on 6th Left entry. Support of roof good."

1902.—Inspected June 24th, A. G. S.—All conditions satisfactory.

1902.—Inspected October 4th; A. G. S.—Sufficient air was entering the mine, but it was not satisfactorily distributed. In

consequence of leaky curtains on room necks on 7th Right, the current did not keep within 60 feet of working faces. In the working places on the 1st Left off Hoar entry, there was not sufficient current to turn the anemometer.

1902.—Inspected November 29th; A. G. S.—Ventilation, drainage and timbering were satisfactory.

No. 3 MINE.

1902.—Inspected June 24th.—Ventilation, drainage and timbering were satisfactory.

1902.—Inspected October 4th; A. G. S.—Drainage and timbering were satisfactory. Ventilation was excellent, except on 1st Right and 1st Left entries—deficiencies in the former being due to old and leaky curtains, and in the latter to a brattice being down. Attention was called to the fact that rooms were being driven more than 60 feet without making break-throughs.

1902.—Inspected November 29th; A. G. S.—All conditions were satisfactory.

STRAIGHT CREEK MINES.

Mine Office, Straight Creek.

Head Office, Louisville.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the National Coal & Iron Co. Theodore Harris, President; M. S. Barker, Vice-president and General Manager (Louisville and Straight Creek); S. H. Stone, Secretary and Treasurer.

These mines were inspected twice in 1901 and thrice in 1902.

No. 1 (A) MINE.

1901.—Last inspection was made by C. W. Logan, September 14th. The report is: "Insufficient air-volume was traversing East entry workings to adequately ventilate same; however the connection with the 1st West entry off Straight Creek B mine lacks only 4 or 5 feet, which will allow the new fan in B mine to ade-

quately ventilate this (A) mine workings from 3d B North entry eastward, which will greatly assist the A mine fan, and evidently improve ventilation. Other conditions were satisfactory.

1902.—Inspected June 23d; A. G. S.—On account of a squeeze on Main entry, it was deemed dangerous for work to be continued in the working places broken off the Main beyond the 2d West entry, therefore instructions were given that operations in Main entry workings between 2d West and the face should be discontinued. Directions were given that no pillars should be pulled in working places on 1-A North entry, the mine having been so laid out in that section and so much coal removed between the Main and 1-A North that it was deemed too hazardous for said pillars to be drawn. It was evident that the squeeze in the mine was caused by pulling all pillars immediately after the double-width rooms had been driven up, the entry pillars being entirely too small to stand such procedure. The top being a heavy sandstone, slow to break, it crushed the thin entry pillars. At the time this inspection was made the company had discontinued the method indicated. An ample volume of air was entering the bank, but it did not properly ventilate the working places; in fact, there was practically no ventilation in the working on 2-B North, or in 1-A, 2-A, and 3-A North. On 1-A North the top was unsafe.

1902.—Inspected October 3; A. G. S.—The condition of the mine had been very much improved since former inspection, the ventilation being satisfactory and the drainage much better. The entries were being strengthened with large, heavy timbers.

1902.—Inspected December 3; A. G. S.—All conditions were satisfactory.

No. 2 (B) MINE.

1901.—Last inspection was made by C. W. Logan, September 14th. All conditions were good.

1902.—Inspected June 23d; A. G. S.—All conditions were satisfactory.

1902.—Inspected October 3d; A. G. S.—The mine was in excel-

lent condition, with the exception of the ten rooms on right side of 1-D North entry, said rooms having been driven beyond the legal limit without break-throughs.

1902.—Inspected December 3d; A. G. S.—All conditions were satisfactory.

TUCKEHOE MINE.

Mine Office, Fourmile.

Head Office, Dayton, O.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the Tuckehoe Coal Co., John Collins, President; W. Foglesong, Vice-President; Ed L. Shell, Secretary, Treasurer, and General Manager. Mine Foreman, A. D. Doran.

There are two openings here, a slope and a drift. The slope was new in 1901. The drift was opened in the summer of 1902. Very little was done at either mine in 1902, the total product for the year amounting to only 1,905 tons. The slope was drowned out, and most of the work done was in making the new opening.

In the autumn of 1901 an electric longwall machine was installed at the slope, but so well as the writer has been able to ascertain it had a short campaign. It was not in use in 1902, and no information of value as to results of the efforts to work the mine longwall has been obtained.

1901.—The slope was inspected twice by Mr. Logan. On the first occasion (April 13th), the mine was new and excavations "limited." General conditions were pronounced good. On the second occasion (September 17th), very little work was going on, the only inside work being that of three miners preparing for the installation of longwall machines, and driving an entry out from second outlet and fan-way. General conditions were pronounced fairly good.

1902.—When the mines were visited on June 25th, it was found that the slope had been idle for several months—said to be waiting for repairs to be made on the longwall machine. A drift opening was being made on the mountain, which had been driven 175

feet. On October 6th another visit was made. The company had abandoned the slope and was just moving its machine to the drift.

Subsequently the mines went into a receiver's hands.

Knox County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Wilton	67,319.30	241.00	33,188.69	100,748.99
Bertha	93,361.85	.....	115,782.30	209,144.15
East Jellico	39,365.50	.....	16,730.80	56,096.30
Ross Jellico	14,078.00	4,155.00	17,487.25	35,720.25
North Pt. Jellico	8,155.11	800.00	10,088.96	19,044.07
Hughes Jellico	3,971.00	3,409.00	17,387.05	24,767.05
Artemus Jellico	9,641.00	3,449.00	7,375.00	20,465.00
Total	235,891.76	12,054.00	218,040.05	465,985.81

ARTEMUS JELICO MINE.

Mine Office, Artemus.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the Artemus Jellico Coal Co., N. A. Ross, President and Treasurer; J. M. Willson, Vice-President; H. A. Ross, Secretary. Mine Foreman, Lee Sexton.

The mine was inspected once in 1901, and twice in 1902.

1901.—Inspected April by C. W. Logan. The report is:

“Barely a legal adequacy in air-volume (5,000 cubic feet per minute) was entering the mine to ventilate the number (fifty) of employes therein. Sixteen or eighteen additional feet must be added to the height of furnace stack to produce stronger draught power.

Better quality of curtain material is essential to better conduct the air-volume to working faces. Conditions in other respects fairly good."

1902.—Inspected June 26th; A. G. S.—The 3d and 4th Right and 3d Left entries were practically without ventilation. The Main entry was 60 feet too far ahead of the air.

1902.—Inspected October 7th; A. G. S.—The ventilation had been much improved, but was still defective in some places. Curtain material used was too light, otherwise the ventilation would have been better. Drainage was much better than when the former inspection was made.

BERTHA MINES.

Mine Office, Bertha.

Head Office, Louisville.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the North Jellico Coal Co., J. B. Speed, President; I. P. Barnard, Vice-President; W. A. Jones, Secretary and Treasurer; C. S. Nield, General Manager. Mine Superintendent, Alex. Frost. Mine Foremen, F. C. Dizney, at No. 1; Leander Castle, at No. 2.

All coal is mined by machine, for which are used: 18 Harrison pick machines, 8 Ingersoll-Sergeant, and 3 Sullivan, all machines being of the same weight, namely, 725 pounds. A Jeffrey air drill is used for the slate top. Air for the machines is furnished by two Norwalk 150 horse-power compressors. Haulage on main lines is by electricity. The plant (which was installed the first part of 1902) includes a Beldon 150-horse-power engine; a General Electric 100-K. W. generator; and four Jeffrey motors, two of 6 tons each and two of 7 tons each. Ventilation is by furnace.

The mines were inspected twice in 1901 and in 1902.

No. 4 MINE

1901.—Last inspections were made by C. W. Logan, September 11th. The report is: "All essential conditions were satisfactory."

1902.—Inspected June 28th; A. G. S.—The volume of air enter-

ing the bank was not quite up to the legal requirement for the number of persons underground (135), and the current was not properly conducted. On 1st Right there was hardly any current; on 2d and 3d Right where there should have been 13,000 to 14,000 feet, the current measured less than 1,000 feet; the 4th and 5th Right were practically without ventilation when needed.

1902.—Inspected October 9th; A. G. S.—All conditions were satisfactory.

No. 5 MINE.

1901.—Last inspection was made by C. W. Logan, September 11th. The report is: "Conditions in all respects were reasonably good."

1902.—Inspected June 28th; A. G. S.—All conditions were satisfactory.

1902.—Inspected October 9th; A. G. S.—All conditions were satisfactory.

EAST JELICO MINE.

Mine Office, Coalport.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the East Jellico Coal Co., S. Taylor Sheaffer, President and General Manager (New Bethlehem, Pa.); R. G. Yingling, Vice-President (Pittsburgh, Pa.); I. M. Shannon, Treasurer (Clarion, Pa.); John F. Brown, Secretary (Clarion, Pa.); Geo. M. Shoemaker, Superintendent; Fred G. Tice, Assistant Secretary and Assistant Treasurer. Mine Foreman, John McGinley.

The mine is ventilated by a 6-foot fan made by Geo. Clark, Windsor Lock, Conn., installed in July, 1900.

About 75 per cent. of the 1902 output was machine mined, pick machines being used. The plant includes: Ten Harrison punchers; two Norwalk compressors, one 16 by 9½ by 14 by 16, of 80 horse-power, and one 14 by 9½ by 12 by 12, of 50 horse-power; one

12 by 18 haulage engine; a 7 by 15 engine for the fan. The boiler battery consist of two Erie City boilers of 62 horse-power each, and one Atlas boiler of 25 horse-power.

The mine was inspected once and visited once without inspection in 1901. Two inspections were made in 1902.

1901.—When inspected by C. W. Logan on April 12th, all essential underground conditions were reasonably good. The mine was visited by Mr. Logan on September 16th. The report is: "This mine has been idle since August 3d, so said Richard Bowen, Superintendent. Inside and outside repairs were being made, preparatory to the resumption of same about October 1st. Under circumstances, no inspection made."

1902.—Inspected June 26th; A. G. S.—An ample volume of air was entering the bank, but none of it reached the working places. Old worked-out rooms were standing open and doors and brattices were leaky. Drainage on the Main entry was bad.

1902.—Inspected October 7th; A. G. S.—The report is: "Ventilation splendid. Drainage and timbering satisfactory."

GRAY'S MINE.

Mine Office, Gray.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by North Point Jellico Coal Co., Mrs. Sarah M. Gray, Proprietor. Mine Foreman, W. T. Robinson.

The mine was inspected twice in 1901 and in 1902.

1901.—Last inspected, C. W. Logan, September 12th. Report is: "The present fire arrangement is drawing an air volume of 5,950 cubic feet air per minute, which is barely a legal adequacy for the 59 persons employed underground. A furnace is strictly necessary immediately, and one must be built with elevated grate bars, as instructed Mr. Robinson at once, to bring ventilation up to the standard required by law. Propping and timbering fairly good. Drainage not good, but essential improvements are well under way."

1902.—Inspected June 27th; A. G. S.—The mine had been neg-

lected until the ventilation had gotten into bad condition; enough attention had not been paid to doors, curtains or brattices, and the timbering in some parts of the mine had also been neglected. Natural means were depended upon to ventilate First Left opening, with the usual result—small and irregular currents. The 1st Right and Straight entries of the main opening had practically no ventilation where needed. Attention was called to the importance of keeping the rooms well propped.

1902.—Inspected October 8th; A. G. S.—A sufficient current was entering the mine, but it did not reach all the working faces. Too much waste was allowed to accumulate in air-courses. Drainage was bad on all entries.

HUGHES JELICO MINE.

Mines at Ely's.

Head Office, Flat Lick.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the Hughes Jellico Coal Co., W. R. Hughes, Proprietor. Mine Foreman, J. T. Main.

This mine was opened by the Ely Jellico Coal Co., which began operations January 1, 1902. It was purchased by Mr. Hughes March 1st, and operated by him under the firm name given above throughout the year.

1. Inspected June 25th; A. G. S.—Very little attention seemed to have been paid to ventilating the mine. Entries were driven ahead of the air and curtains on the rooms were in bad condition. Sufficient air was entering the mine but it did not reach the men.

2. Inspected October 6th; A. G. S.—The ventilation had not been improved. The furnace was incapable of supplying an adequate quantity of air throughout the mine. Not enough air was entering the bank. A new furnace was to be built.

3. Inspected December 4th; A. G. S.—The condition of the mine had been greatly improved, and the ventilation was much better. A new furnace had been built, which furnished sufficient current, but the latter did not reach all the working faces.

ROSS JELICO MINE.

Mine office, Gray.

Head Office, Barboursville.

Transportation, C. V. Branch of L. & N. Railroad.

Operated by the Ross Jellico Coal Co., N. A. Ross, President; J. M. Ross, Vice-President and Secretary. Mine Foreman, P. M. Wilburn.

The mine was inspected twice in 1901 and in 1902.

1901.—The last inspection was made by C. W. Logan, September 12th. The report is: "The mine was idle, only a few miners were in making ready coal, and very little fire was in the furnace, but, from appearance of brattices, etc., with good fire in furnace, I have reason to believe ventilation good. Conditions in other respects satisfactory."

1902.—Inspected June 27th; A. G. S.—All conditions were satisfactory.

1902.—Inspected October 8th; A. G. S.—All conditions were satisfactory.

WILTON MINE.

Mine Office, Wilton.

Head Office, Louisville.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the North Jellico Coal Co. (See Bertha Mines.)

This mine, which is situated about $4\frac{3}{4}$ miles southwest of Woodbine, and connected by a spur with the L. & N. track at that point, was not fully opened until in the spring of 1902, though work (including construction of the spur track) was commenced early in 1901, and 835 tons of coal taken out in December, 1901. The mine has been handsomely equipped for electric haulage and coal cutting machines—all the output being machine mined. The plant includes: A 350-horse-power Harrisburg engine, driving a 200-K. W. General Electric generator (direct connected); two Babcock & Wilcox boilers, 150-horse-power each; three 7-ton Jeffrey electric locomotives; six Jeffrey "16A" Low Vein chain breast ma-

chines; five Morgan-Gardner "S" Low Vein machines; one Morgan-Gardner Standard "D" machine; one duplex electric pump; one stationary motor, to drive shop fan, lathe, and drill press.

The mine is ventilated by a Johnston fan, driven by a 30-horsepower General Electric motor.

1. Inspected March 28th; A. G. S.—The Wallace entry was ahead of the air, and curtains on that entry were in bad condition. The roof at head of the Anderson entry needed attention.

2. Inspected September 30th; A. G. S.—All conditions were satisfactory.

Laurel County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Altamont .....	.....	.....	12,398.00	12,398.00
Pittsburgh	8,673.00	.....	51,479.00	60,152.00
Bastin & Pritchard	3,549.00	1,365.00	17,504.00	22,418.00
New Diamond	44,954.00	14,497.00	7,976.00	67,427.00
G. W. Curvin .....	.....	.....	10,235.00	10,235.00
Manchester	28,181.67	.....	10,083.05	38,264.72
Leota (Lily)	4,290.50	4,820.00	2,445.00	11,855.50
Pitman	6,762.00	.....	50,407.00	57,169.00
Standard	3,588.00	3,582.00	22,316.00	29,486.00
Star	14,343.40	895.00	7,881.60	23,120.00
Laurel	11,785.00	1,340.00	38,930.00	52,055.00
Total	126,126.57	26,499.00	231,954.65	384,580.22

CURVIN'S CRESCENT MINE.

Mine Office, Viva.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by G. W. Curvin.

During the year the mine which was operating in 1901 was abandoned and a new opening was made. The old mine was inspected twice in 1901, the last inspection being on September 23d. It was inspected March 20th and May 9th, 1902, and found in a defective condition each time. A third visit was made July 26th, but the mine had by then been abandoned and a new opening, in which only three men were employed was being made. The Main had been driven about 200 feet.

FLAT TOP MINE.

Mine Office, Altamont.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Altamont Coal Co., H. C. Thompson, President and General Manager.

During the first part of the year the mine was operated by the Flat Top Coal Co., which, however, was under the same management as the present company.

1901.—Notice concerning the condition of this mine as on June 12th is included in the office copy of notice of same date served on the Laurel Coal Co. by Mr. Logan. It seems, therefore, that in 1901 the mine was controlled by said company. The notice as to Flat Top is: "Ventilation reasonably fair. Much water comes through this coal, hence drainage not very good. No neglect to post working rooms or timber entries observed."

1902.—Inspected March 28th; A. G. S.—The furnace was a poor affair and hardly any current was entering the mine. Curtains and doors had been neglected so long that even had there been a good current it would not have traveled the working places. Drainage was very bad. At this time 49 persons were employed underground.

1902.—Inspected May 10th, A. G. S.—No improvement had been made in the condition of the mine.

1902.—Inspected July 29th; A. G. S.—The condition of the mine had not been improved. Natural means were depended upon for ventilation. The following statement appears in the report: "On my last visit to this mine I was assured that this company would put the mine in proper condition. I was also assured that the new air-shaft would be completed in a very few days, and a furnace of ample power to ventilate the mine would be built. I have been under the impression that this was done. The air-shaft is completed but no arrangements whatever for building a furnace have been made."

1902. Inspected October 10th; A. G. S.—Practically no improvement had been made. A basket had been hung in the air-shaft, but did not have sufficient power to ventilate the mine. Drainage was still bad.

Upon advice of the Assistant Inspector, based upon representations that had been made to him, steps to indict this company for failure to comply with the law were deferred. It is evident, however, that this office has made a mistake in the matter and that extreme measures should have been taken.

LAUREL MINE.

Mine Office, Pittsburgh.

Head office, Pittsburgh.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Laurel Coal Co., Geo. Givens, President; J. W. Bastin, Secretary and General Manager. Mine Foreman, James Bastin.

A large part if not the larger part of the output of this company for 1902 was produced from a new opening made during the year. Early in the spring the work in the old mine was down to drawing pillars and stumps. Ventilation is by furnace.

Inspected once in 1901 and three times in 1902.

1901.—Inspected by C. W. Logan, June 12th. The notice is:
"Ventilation not bad. Drainage not good. A pump placed on

1st Right entry will result in better drainage, and the roadway of 2d Right entry must be corduroyed immediately as instructed mine boss."

1902.—Inspected March 18th; A. G. S. —Ventilation was only fairly good, and timbering the same. Drainage was bad. Operations consisted principally of drawing pillars and stumps.

1902.—Inspected May 8th; A. G. S. —The only work was on the 1st Right and ventilation was defective there because of failure to hang a good curtain on the Main.

1902.—Inspected July 31st; A. G. S.—Three entries were working. All conditions were satisfactory, except on the 2d Right, where the ventilation was not sufficient.

LILY MINE.

Mine Office, Lily.

Head Office, Louisville.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Leota Coal and Coke Co., A. S. Myer, President; P. J. Millett, Vice-President (Knoxville, Tenn.); G. R. Hunt, Jr., Secretary and Treasurer. Manager at mine, J. H. Cochran. Mine Foreman, W. M. Heath.

This mine appears to have changed hands several times within the last two years.

The output for 1902 was mined by hand, but recently an equipment for machine mining, consisting of 6 Harrison machines and a Norwalk, 22 by 24 compressor, was purchased, and machine mining started February 1, 1903.

Three inspections were made by C. W. Logan, in 1901, the mine then being under control of K. F. Bierach & Bro. Company. Four inspections were made in 1902.

1901.—Last inspection was made by C. W. Logan, September 27th. The notice is: This mine was idle and furnace cold. From appearance of clogged air-ways, neglected brattices, etc., ventilation is not good; and it was further observed that the instructions given in notice No. 163 under June 15th, date in regard to driving

2d Right Cross off 3d Right entry outside had not been complied with, and this is strictly essential for betterment of ventilation, and must be done immediately. This matter must not receive remiss consideration. Conditions in other respects just fairly good."

1902.—Inspected March 29th; A. G. S.—The mine was found to be in very bad condition in every respect. No air was traveling any of the working places; indeed there was practically no current entering the mine. The top throughout the mine was in dangerous condition.

1902.—Inspected May 6th; A. G. S.—The only work consisted of driving a necessary entry to daylight; both ends were being double shifted. The total distance to drive was estimated at 270 feet, of which 45 feet had been driven. Preparations were under way for the installation of a 10-foot fan.

1902.—Inspected July 25th; A. G. S.—Conditions had been very much improved. Ventilation was better, but still inadequate. The fan, however, had not yet been put in place, though the work of installing it was being pushed.

1902.—Inspected October 1st; A. G. S.—The fan was running and ventilation was good. Drainage was improved and no lack of necessary timbering was observed.

MANCHESTER MINE.

Mine Office, East Bernstadt.

Head Office, East Bernstadt.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Manchester Coal Co., C. R. Coleman, Manager; John W. Harris, Secretary. Mine Foreman, A. T. Wilson.

The mine was inspected twice in 1901 and three times in 1902.

1901.—Last inspection was made by C. W. Logan, September 25th. The notice is: "Drift No. 2. Ventilation will be improved when proper grate bars are placed in furnace, and Main entry door hung on above 1st Left entry, as talked with Mr. Wilson, bank boss, so that the intake air-volume will remain regular. Drainage, propping and timbering fairly good."

"Drift No. 1. Small furnace built near pump-shaft bottom is essential to properly ventilate this mine, even considering that its workings are inextensive and underground force small. Otherwise conditions are good as expected."

1902.—Inspected March 20th; A. G. S.—The ventilation on 1st and 2d Right entries was insufficient because of lack of good curtains. The 1st Right had been driven 120 feet ahead of the air.

1902.—Inspected May 9th; A. G. S.—All the entries had been driven too far ahead of the air, otherwise ventilation appeared reasonably good.

1902.—Inspected July 26th; A. G. S.—An ample volume of air was entering the mine, but it did not reach all the working faces. The current was short on both 2d Right and 1st Right. Apparently the horse power of the furnace was inadequate to meet the requirements of the mine. Drainage needed attention. In some of the rooms props were not kept close enough to the faces.

NEW DIAMOND MINE.

Mine Office, Altamont.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the New Diamond Coal Co., R. M. Jackson, President (London, Ky.); Wm. H. Kinnaird, Vice-President; H. C. Thompson, General Manager.

The mine is ventilated by a 12-foot Cole fan.

About 75 per cent. of the output for 1902 was machine mined. The plant includes eight pick mining machines,* of which six are Harrison "G G G" (weighing 700 pounds each), one Ingersoll-Sergeant (weighing 750 pounds), and one Sullivan (weighing 600 pounds). Air is furnished by a Norwalk, 20 by 22 by 24 compressor. The boiler battery consists of two 100-horse-power, 66 inches by 16 feet boilers, each having fifty-two 4-inch flues.

*In April, 1903, the company expected to have installed in May in addition Norwalk compressor same size as the one already in use), and four more Ingersoll-Sergeant, 700-lb. mining machines. It also expected to install additional 100 horse power during the coming summer.

The mine was inspected twice in 1901, by C. W. Logan, and four times in 1902.

1901.—Last inspection was made September 25th. The notice is: "All essential underground conditions were highly satisfactory."

1902.—Inspected March 19th; A. G. S.—The mine was in very bad condition in all respects, i. e., as to ventilation, drainage, and timbering.

1902.—Inspected May 8th; A. G. S.—The condition of the mine had been improved somewhat, especially in regard to drainage. On the 9th Right the air did not traverse the rooms.

1902.—Inspected July 28th; A. G. S.—In the notice, it is stated: "On my former visit to this mine I was under the impression that the company intended putting it in proper condition, and it was improved somewhat. But this inspection showed the conditions to be worse than ever." Not enough current was found on 7th Left and 8th Left entries. On 9th Left a volume of 7,710 cubic feet of air was traveling the working places, but since this was the way for the total current required (10,200 feet) to come the current was deficient. Curtains on rooms in this entry were old and leaky. Some rooms were 50 feet wide with only 10-foot pillar, the cause apparently of a squeeze on 8th and 9th Left entries. On the 10th Right, where the total current should have been traveling the curtain at the mouth of the entry was in such poor condition that only 2,016 feet could be measured. Entry faces were allowed to get too far beyond the air. Timbering was not sufficient in some places. The mine was too wet and muddy.

1902.—Inspected October 11th; A. G. S.—The general statement in regard to the mine is as follows: "This mine was not properly ventilated, sufficient air was entering the bank, but no provisions had been made for sending it within 60 feet of the working faces as required by law. The curtains all leak, and no new ones have been provided, although your attention has been called to this matter at least twice. Rear break-throughs are left

open and the air spills out to the entry. I see no improvement whatever in the condition of the mine."

The failure of this company to comply with notices to put its mine in lawful condition was brought to the attention of Hon. J. L. Isaacs, Commonwealth's Attorney of the district, on October 21, 1902, and affidavit sent him with request that he take up the matter and enforce compliance with the law. Having had no response from Mr. Isaacs, it is not known what, if any, steps he has taken.

NEW STAR MINE.

Mine Office, East Bernstadt.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Star Coal Co., S. L. Bastin, General Manager; J. D. Pritchard, Superintendent.

The mine was inspected twice in 1901 and thrice in 1902.

1901.—Last inspection was made by C. W. Logan, September 26th. The notice to company is: "Ventilation satisfactory. Broken anemometer prevented measurement of new furnace draught power. However, it is believed to have good ventilating capacity."

1902.—Inspected March 19th; A. G. S.—Ventilation was not sufficient in the working places on the 2d Left on account of leaky curtains.

1902.—Inspected May 8th; A. G. S.—Sufficient current was entering the mine, but in parts of the mine ventilation was defective. The current was not traveling the rooms on the 2d Left, a door instead of a curtain being needed on the mouth of the entry. The head of the Main entry had been carried too far beyond the air.

1902.—Inspected July 28th; A. G. S.—The quantity of air entering the bank was ample, but it was not reaching the working faces satisfactorily. Bad curtains were chiefly responsible for the deficiencies in ventilation.

1902.—Inspected October 10th; A. G. S.—Conditions had been improved, but bad curtains on rooms on 1st Right and 3d Left pre-

vented those rooms from being properly ventilated. It was also observed that waste was allowed to accumulate in air-courses, which, of course, obstructed the current and prevented satisfactory ventilation.

OLD STAR MINE.

Mine Office, East Bernstadt.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by Bastin & Pritchard, S. L. Bastin, General Manager; J. D. Pritchard, Superintendent.

1902.—When visited May 10th the drift was idle.

1902.—Inspected July 29th; A. G. S.—Sufficient air was not passing into the mine, and such quantity as did enter was not properly distributed to the working faces. Drainage and timbering were also defective.

PITTSBURGH MINES.

Mine Office, Pittsburgh.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Pittsburgh Coal Co., R. C. Ford, President (Middlesboro); R. M. Jackson, General Manager (London, Ky.); C. W. Wood, Secretary. Robert McNeill, Mine Superintendent.

This company came into control of the property February 13, 1901. A new opening was begun the latter part of 1901, from which shipments were begun early in 1902. Ventilation is by furnace.

The mine was inspected twice by Mr. Logan, in 1891, and three times in 1902.

1901.—Last inspection was made September 26th. The notice is: "This mine is just resuming after a suspension of several weeks, and conditions naturally are not good under circumstances. Many improvements are needed, as discussed with Mr. Reynolds, to properly ventilate and drain the mine, and he assured me that his earnest attention would be directed toward carrying out my

verbal instructions in regard to building a furnace near head of 1st Left entry; and the construction of doors, brattices, etc., as minutely indicated. Conditions otherwise fair."

1902.—Inspected March 17th; A. G. S.—The ventilating current was not sent through the workings in the Drift mine properly, the current escaping to old works through a hole at about 250 yards from the mouth. In the Slope sufficient air entered the bank, but on account of losses a sufficient quantity did not reach the workings.

1902.—Inspected May 7th; A. G. S.—*The Drift Mine:* Ventilation and drainage were much improved, the mine being in good condition.

The Slope.—There was practically no current entering the mine. The roof in West Main was in a dangerous condition, needing careful timbering.

1902.—Inspected July 30th; A. G. S.—*The Drift Mine:* Except on the Klondyke entry, operations were confined to drawing pillars and stumps. In the Klondyke, which has ventilation separate from other parts of the mine, the ventilation was deficient in quantity. Conditions where pillars and stumps were being drawn were as good as could be expected.

The Slope.—Enough current was entering the bank but it did not reach all the working places. The furnace seemed inadequate for the work demanded of it. A new furnace was to be built. On the 1st Right the current was too weak to turn the anemometer, and at the head of the 1st Left the current was too weak to measure.

PITMAN MINE.

Mine Office, Pittsburgh.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Pitman Coal Co., W. A. Pugh, President; S. V.

Rowland, Treasurer and General Manager (Danville);* J. I. Caldwell, Secretary. Mine foreman, D. W. Booker.

The mine was inspected once in 1901 and thrice in 1902.

1901.—Inspected September 26th, by C. W. Logan. The notice is: "This is a new mine, properly and modernly equipped, and in perfect condition in all respects."

1902.—Inspected March 18th; A. G. S.—Ventilation was very good, but the mine was too wet.

1902.—Inspected May 7th; A. G. S.—A sufficient current was entering the mine, but it was not conducted so as to reach all the working faces.

1902.—Inspected July 31st; A. G. S.—The air current was deficient. In the 1st Right where the total current for 76 persons underground should have been passing, there were 5,232 feet; in the 2d Right the total current had dwindled to 3,402 feet, and in the 4th Left to 3,000 feet, at points where all should have been passing. Leaky curtains on entries seemed in part responsible for the shortness of the current. Some of the entries had been driven too far beyond the air. In some rooms props were not close enough to faces.

STANDARD MINE.

Mine Office, Viva.

Transportation, Knoxville Branch of L. & N. Railroad.

Operated by the Standard Coal Co., S. J. Thompson, President;

*Since preparation of this report was undertaken Mr. Rowland has died, his death occurring on March 31st. He had been in delicate health for some years, but to those who had met with him at the Coal Operators' Meeting, held but a few weeks earlier, for the purpose of assisting the Kentucky Exhibit Association to make a State exhibit at the Louisiana Purchase Exposition, and over which he presided, the news of his death came as a surprise. The writer is informed that he contracted a severe cold a short time preceding his death which, coupled with asthma, in his feeble physical condition, caused his death. Mr. Rowland was one of the founders of the Pitman Coal Company, in 1881, and continued in the active discharge of his duties as Treasurer and General Manager up to shortly before his death. He was a gentleman of the highest type; a just man, though patient with the frailties of others. One who for many years was associated with him in business has truly said of him that he was loved by all who knew him. He is succeeded by Capt. W. A. Pugh as General Manager, and by Mr. J. L. Caldwell as Treasurer.

C. H. Moses, Secretary; J. M. Thompson, General Manager. Mine Foreman, A. Bryant.

The mine was inspected twice, by C. W. Logan, in 1901, and thrice in 1902.

1901.—Last inspection was made on September 25th. The notice is: "Ventilation for the 60 underground operatives fairly good, excepting 2d Right entry, which is smoky and has no air-circulation. However, this defect will be readily remedied with some brattices repaired, as Mr. McBrayer assured me would be immediately attended to. No dangerous neglect to timber entries or post rooms observed. Drainage reasonably fair.

1902.—Inspected March 20th; A. G. S.—On account of poor curtains on rooms, the workings on Dawson, Jarvis, and Cornelius entries was not sufficient.

1902.—Inspected May 9th; A. G. S.—There was practically no current entering the mine, and had there been one it would not have properly reached the working faces.

1902.—Inspected July 26th; A. G. S.—The condition of the mine was even worse than before. The furnace was practically useless. Instructions to build a suitable furnace were given.

1902.—Inspected October 11th; A. G. S.—A new furnace had been built, but there was still a failure to get the air properly to the working faces, the rotten condition of old brattices and unserviceable curtains on rooms being in part responsible therefor.

This company should have been reported to the Commonwealth's Attorney, and it was only through a misunderstanding on the part of the Chief Inspector that it was not done.

Pulaski County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Alpine	5,238.60	13,502.50	20,629.40	39,370.50
Cogar Creek	1,275.00	3,210.00	.....	4,485.00
Nixon	140.00	.....	700.00	840.00
Cumberland	8,047.50	21,605.00	5,735.00	35,387.50
Eagle	17,705.85	41,727.45	12,562.50	71,995.80
Indian Creek	500.00	510.00	990.00	2,000.00
Indian Head:.....	1,540.00	.....	3,173.50	4,713.50
Paris	1,410.00	370.00	5,110.00	6,890.00
Total	35,856.95	80,924.95	48,900.40	165,682.30

ALPINE MINE.

Mine Office, Alpine.

Head Office, Chattanooga, Tenn.

Transportation, Cincinnati Southern Ry.

Operated by the Alpine Coal Co., J. T. Hill, General Manager and Treasurer. Mine Foreman, Neil Bouyer.

The mine was inspected twice, by Mr. Logan, in 1901 and twice in 1902.

1901.—Last inspection was made November 15th. The notice is: "Eighteen thousand (18,000) cubic feet air per minute was entering the mine. However, owing to leakage, the inadequate air current of 4,400 cubic feet per minute was passing into the right entries for the 50 diggers therein, and the following instructions must be immediately complied with for the betterment of ventilation in this mine workings. Another door on Main Left above lie-way was ordered, also 1st Left Cross (Armstrong) entry must be

bratticed at mouth and a door hung near furnace approach, with the present door removed as discussed with mine boss, to allow an uninterrupted return air-volume to furnace, which has fairly good draught power.' '

1902.—Inspected May 3d; A. G. S.—A volume of only 3,934 cubic feet of air was entering the mine, to supply 58 persons underground. The mine was in a bad condition generally. Roads were too wet and muddy. The roof of the Sloan entry was in a dangerous condition and needed scaling.

1902.—Inspected August 7th; A. G. S.—The mine was in a somewhat better condition, but was still far from being in a satisfactory one. The air supply was insufficient and proper provisions had not been made for conducting the current to working faces. A fan had been procured and was on the ground, however, and assurances were given that there would be no delay in installing it, and putting the mine in proper shape.

BARREN FORK MINES.

Mine Office, Barren Fork.

Head Office, Lexington.

Transportation, Cincinnati Southern Ry.

Operated by the Eagle Coal Co.; J. T. Slade, President and General Manager; Jas. Todd, Secretary; J. F. Jaeger, Treasurer; W. L. Carter, Superintendent (Barren Fork). Mine Foreman, John Burris.

The mine is ventilated by a 10-foot fan, made at the company's shop.

The mine was inspected, by Mr. Logan, twice in 1901. Two inspections were made in 1902.

1901.—The last inspection was made November 16th. The report is: "Conditions in all respects are reasonably good."

1902.—Inspected May 1st; A. G. S.—On account of the condition of the curtains, the air did not properly travel the rooms on Entry 6. First Left and Clark entries had been driven too far ahead of the air.

1902.—Inspected August 9th; A. G. S.—An ample volume of air was entering the mine, but because of leaky curtains and brattices did not reach some of the working faces. Timbering good. Drainage bad, necessitating a pump.

CUMBERLAND MINE.

Mine Office, McGuffey.

Head Office, Harriman, Tenn.

Transportation, Cincinnati Southern Ry.

Operated by the New Cumberland Coal Co., Jesse L. Rogers, President; J. W. Staples, Manager; A. C. Terry, Secretary and Treasurer. Mine Foreman, H. C. Cain. Shipping point, Williams' Siding, near Flat Rock Station.

For the larger part of the year the mine was operated by the Cumberland Coal Co., of which H. A. Williams was President, and J. E. Williams was Secretary.

Year 1901.—1. The mine was inspected once in 1901, on June 19th, by Mr. Logan. The report is: "Essential conditions in all respects were good. Doors should be substituted for curtains on 2d Right and 2d Left entries."

2. On November 16th, Mr. Logan notes that the mine (Williams' Drift) was idle, hence was not inspected.

Year 1902.—1. An inspection made April 30th showed the mine to be in good condition in all respects.

2. An inspection made August 8th showed the condition to be defective. Sufficient air was not entering the mine, and what there was, was not properly conducted. Curtains and brattices had been neglected, and entries had been driven too far beyond the air. Drainage was also bad, and required the installation of a pump to better it.

Subsequent to the foregoing inspection the New Cumberland Coal Co. acquired the property, taking charge September 10th. In January of the present year (1903) they were putting in a pump and pipe lines to remedy the defects as to drainage.

INDIAN HEAD MINE (Indian Creek.)

Mine Office, Parker's Lake. R. R. Station, Cumberland Falls.

Transportation, Cincinnati Southern Ry.

Operated by the Indian Head Coal Co., C. T. Cory, President; H. L. Cory, General Manager; S. E. Rich, Secretary and Treasurer. Head office, Harriman, Tenn. Mine Foreman, Berry Simpson.

This is a new company which acquired the "Indian Creek" property in the latter part of 1902, and commenced operations in October. The "Indian Creek" mine was operated four months in 1902 by Joe C. Parker, and then shut down. The new company abandoned that mine, when it took charge, and opened a new one.

Year 1901.—The *Indian Creek Mine* was examined once in 1901, on June 19th, by Mr. Logan. The report is: "This work is limited, and practically all open-ended; and I think conditions are reasonably fair; however, the mine was idle at the time of inspection, and a very thorough air determination could not be obtained."

2. According to memorandum of Mr. Logan, on November 16th the mine was idle, had been so for several days, no one was about it, and no inspection was made.

Year 1902.—The mine was visited April 20th, but had been shut down.

The Indian Head mine, opened by the present company, began putting out coal about November 1st. It was not inspected during the year covered by this report.

NIXON MINE (Cogar Creek.)

Mine Office, Flat Rock. Head Office, Chattanooga, Tenn.

Transportation, Cincinnati Southern Ry.

Operated by the Nixon Coal Co., G. W. Nixon, President; W. J. Nixon, General Manager. Mine Foreman, James Garrett.

This company has the property formerly controlled by the Cogar Creek Coal Co., but it is not operating the old mine.

Old Cogar Creek Mine.—This mine was worked by S. P. Hunni-

cutt, R. F. Peters, and F. Peters, Lessees, for six months in 1902, and then shut down. It was inspected April 30, 1902, and found to be in bad condition in every respect. Notice was given to remedy the evils, but, as indicated, the mine was shut down within a few weeks thereafter and has not been operated since. According to the office records, the mine was not operated in 1901.

Nixon Mine.—This is a new mine, opened by the Nixon Coal Company, which commenced operations in November. It was not more than fairly well opened by the end of the year (having produced only 840 tons in the remaining two months) and was not inspected in 1902.*

PARIS MINE.

Mine Office, Parker's Lake.

Transportation, Cincinnati Southern Ry.

Operated by Paris Coal Co., Joe C. Parker, Manager.

This mine does not seem to have been inspected in 1901, possibly on account of the irregular times at which it was in operation.

1902.—Inspected April 29th; A. G. S.—The mine being idle and the furnace cold, the question as to quantity of air entering the mine when the latter was in operation could not be determined. The indications were, however, that the mine was not sufficiently ventilated. The roof of Entry 2, from Main to face was in a dangerous condition, needing scaling. Props were not kept up close enough to room faces.

1902.—Inspected August 8th; A. G. S.—No improvement had been made in the condition of the mine. Practically no air current was entering the mine—the furnace was doing no good; a better furnace was needed. The Main entry was too wet and muddy.

*An inspection in January of the present year (1903) showed the mine to be in satisfactory condition.

Whitley County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
East Tennessee	29,986.50	27,421.00	10,567.00	67,974.50
Mountain Ash	27,542.00	4,723.00	24,386.00	56,651.00
Mount Morgan	9,569.50	22,352.75	24,342.50	56,264.75
Kensee and Blue Gem ..	42,390.00	836.00	72,934.00	116,160.00
Hoffman & Berry	5,311.20	2,723.05	14,748.15	22,782.40
Whitley Co. (Halsey) ...	3,748.10	586.50	3,373.60	7,708.20
Lou. Prop. Co. (Halsey) .	5,557.53	924.85	2,045.70	8,528.08
Cockill .....	.....	.....	591.00	591.00
Watts Creek	2,002.43	4,760.59	13,178.25	19,941.27
Procter & Grinstead ...	39,194.00	7,677.00	119,230.00	166,101.00
West Jellico	10,557.50	1,985.00	26,597.50	39,140.00
Pine Knot	15,672.00	19,577.00	36,514.00	71,763.00
Cordell & Co. ....	.....	.....	1,682.85	1,682.85
Klondyke (Ratcliffe) ..	4,025.00	4,389.00	320.00	8,734.00
Total	195,555.76	97,955.74	350,510.55	644,022.05

COCKILL BLUE GEM MINE.

Mine and Head Office, Williamsburg.

Transportation, L. & N. Railroad.

Operated by the Cockill Coal Co., E. Cockill, President; H. S. Cockill, Vice-President; J. W. Cockill, General Manager.

This mine made its first shipment in November, 1902. The coal worked is locally known as the "River Vein," runs from 28 to 34

inches in thickness, and blocks well in mining. The company commenced grading for side-tracks and tramway about July 1, 1902, and, all things considered, did well to be able to make shipments in November. No inspection of the mine could be made before the close of the year.

DOWLAI MINE.

Mine Office, Jellico, Tenn.

Head Office, Knoxville, Tenn.

Transportation, L. & N. Railroad and Southern Ry.

Operated by the East Tennessee Coal Co., E. J. Davis, President and Treasurer; W. E. Davis, General Manager; F. C. Richmond, Secretary. Mine Foremen: H. C. Goins, at Dowlais No. 1; D. D. Jenkins, at Dowlais No. 2.

No. 1 Dowlais is ventilated by a 12-foot Cole fan, installed in 1901.

These mines were inspected twice in 1901, by C. W. Logan, and visited once by Mr. Stone. Three inspections were made in 1902.

No. 1 MINE.

1901. The last inspection was made by Mr. Logan, September 9th. The notice is: "Ventilation satisfactory (fan erected). Drainage not very good. Support of roof adequate."

1901. Memorandum of G. W. Stone, December 20th, relating to this and other mines in the region: "December 13 to 19, 1901, I visited the following mines in the Jellico district, and inquired into their general conditions. Halsey, Dowlais 2 mines, Procter and Grinstead, Kensee, Mountain Ash, Watts' Creek Coal Co., and Hoffman & Berry—the two latter near Mahan. The weather was exceedingly bad, and I was not well, and my health in view of the weather was not sufficient to inspect the mines with safety to myself, and I turned them all into visits and inquiries, and all conditions everywhere were reported good."

1902. Inspected March 24th; A. G. S.—On account of defective

room curtains, the working places on the Guy and the Cole entries were not adequately ventilated, indeed, there was practically no ventilation at the working faces on those entries. The Guy and Lunsford entries were too wet and muddy.

1902.—Inspected September 27th; A. G. S.—Ventilation was again found defective, on account of worthless curtains. There was practically no current in workings on the Guy, Cole, and McClellan entries.

1902.—Inspected December 9th; A. G. S.—In the workings of the Cole entry the volume of the ventilating current was less than half as large as it should have been. In the McClellan entry, and in No. 2 Main there was practically no current.

NO. 2 MINE.

1901.—The last inspection was made by C. W. Logan, September 9th. The notice is: "This mine is reasonably well ventilated excepting 1st Right entry, which will be improved in this respect when Lacey entry is driven to the outside, also some repairs to some curtains on 7th Left entry are needed, where indicated Mr. Jenkins, to properly conduct the air volume of 8,100 cubic feet per minute, passing into the mine for the 20 inside employees. Conditions otherwise just fairly good."

1902.—Inspected March 24th; A. G. S.—The workings on 6th and 7th Left entries were without sufficient ventilation. The mine generally was too wet—too much water allowed to accumulate.

1902.—Inspected September 27th; A. G. S.—All conditions were satisfactory.

1902.—Inspected December 9th; A. G. S.—All conditions were satisfactory.

HALSEY MINES.

Mine Office, Halsey.

Telegraph Office, Jellico, Tenn.

Transportation, L. & N. Railroad and Southern Ry.

Operated first half of year by the Whitley Coal Co. Operated second half of year by the Louisville Property Co., T. Cairns, Gen-

eral Agent (Pineville); J. W. Stillwell, Superintendent; R. O. Gal-
leher, Mine Superintendent; J. R. Justice, Engineer in Charge (Jel-
lico). Mine Foreman, G. W. Pickles.

The new company is preparing to work the mines on a large
scale. A new tipple is to be built and the railroad extended about
two miles to a new mine.

Most of the work both in 1901 and 1902 was done in the Vander-
pool mine. That mine was inspected twice in 1901, by Mr. Logan,
and three times in 1902. The Birdeye mine was inspected twice,
by Mr. Logan, in 1901. It was idle on each occasion that the mines
were visited in 1902.

VANDERPOOL MINE.

1901.—Last inspection by C. W. Logan, was made September
7th. The notice is: "Conditions in regard to ventilation are rea-
sonably good. 9,750 cubic feet air per minute entering the mine for
the 43 operatives therein. Drainage, propping and timbering satis-
factory."

Mr. G. W. Stone's visit, in December, is noted in memorandum
under the Dowlais mines.

1902.—Inspected March 25th; A. G. S.—Conditions were good
except on 1st Left, where better curtains were needed.

1902.—Inspected September 26th; A. G. S.—All conditions were
satisfactory.

1902.—Inspected December 8th; A. G. S.—All conditions were
satisfactory.

BIRDEYE No. 3.

1901.—Last inspection was made by C. W. Logan, September
7th. The notice is: "Seven thousand five hundred (7,500) cubic
feet air per minute represented the air-split from fan for 6 men on
No. 3 entry pulling pillars and stumps. Four doors are needed on
first four places from entry face to entry air-current near head of
No. 2 entry, where 30 miners are employed. Other inside condi-
tions fairly good."

1902.—As stated above, the mine was idle on each occasion which Halsey was visited in 1902. The total output of the Birdeye cannal for the year amounted to only 516 tons.

HOFFMAN & BERRY MINE.

Mines at Hoffman Station.

Postoffice, Williamsburg.

Transportation, L. & N. Railroad.

Operated by C. G. Hoffman and F. K. Berry.

This mine, which is about five miles northeast of Williamsburg, was opened in the latter part of 1901. Ventilation is induced by an 8-foot Fair fan, installed in 1902.

1. Inspected March 26th; A. G. S.—The mine was practically without ventilation.

2. Inspected September 30th; A. G. S.—An 8-foot fan had been put in. Ventilation was excellent. Timbering was good. Entries were too muddy.

3. Inspected December 10th—Except the muddy entries, the mine was in satisfactory condition. Some parts of the entries had been corduroyed since previous inspection.

MAIN JELICO MOUNTAIN MINES.

Mine Office, Kensee.

Head Office, Louisville.

Transportation, L. & N. Railroad and Southern Ry.

Operated by the Main Jellico Mountain Coal Co., T. C. du Pont, President; Hywel Davies, Vice-President and General Superintendent; W. D. McElhinny, Secretary and Treasurer. Mine Foreman, John Burris.

Kensee mine was inspected twice in 1901 by C. W. Logan. Mr. Stone's visit is noted in his memorandum of December 20th, under Dowlais mines. Three inspections were made in 1902. The Blue Gem was opened in 1902, and it received two inspections.

KENSEE MINE.

1901.—Last inspection was made September 9th. The notice is: "Second Left off straight 2d entry is driven outside and utilized as an intake way, therefore ventilation is satisfactory. Drainage fairly good. No neglect to support the roof in rooms or on entries observed."

1902.—Inspected March 22d; A. G. S.—The mine generally was in good condition.

1902.—Inspected September 25th; A. G. S.—An ample volume of air was entering the bank, but was not carried to some of the working faces. Room curtains on some of the rooms on entry 6 off Main 1, and on Foster off Main 3 were not good.

1902.—Inspected December 6th; A. G. S.—The mine was insufficiently ventilated. Plenty of air was entering, but a number of working places were practically without ventilation. This was true of three of the working places on Foster, Selby and Lewis entries. The intake for the Old Simmons, New Simmons, and Malacha entries was ample, but in the New Simmons and Malacha the working faces were practically without ventilation.

BLUE GEM MINE.

1. Inspected September 25th; A. G. S.—All conditions were satisfactory.

2. Inspected December 6th; A. G. S.—Efforts were being made to ventilate the mine with a small basket in a small stack (no shaft), but without success. There was not sufficient current in the mine to be measured by means of an anemometer.

MOUNTAIN ASH MINES.

Mine Office, Mountain Ash.

Telegraph Office, Jellico, Tenn.

Transportation, L. & N. Railroad.

Operated by the Jellico Coal Mining Co., Arthur Groves, President; E. J. Davis, Vice-President; Howell J. Davis, Secretary and

Treasurer; W. T. Lewis, Manager. Mine Foreman, Jonathan Jenkins.

About 50 per cent. of the output for 1902 was machine mined, 12 pick machines being used. The coal cutting plant was installed in August, 1902, and consists of the following: One Norwalk 28 by 30 compressor; eleven Harrison and one Ingersoll-Sergeant machines.

These mines were inspected twice in 1901, by C. W. Logan. Three inspections were made in 1902.

1901.—Last inspection was made September 10th. The notice is: "*Drift No. 4.*—10,550 cubic feet air per minute returning to furnace for the 50 men inside. Hence, ventilation fairly good considering class of work. Drainage not very good, but a ditch is nearing completion that will naturally improve same. Roof very well supported. *Drift No. 3.*—45 persons work inside 9,200 cubic feet air per minute entering the mine, which is reasonably well conducted to all immediate workings. Conditions in other respects good."

Mr. Stone's visit in December is noted in his memorandum under Dowlais mines.

1902.—Inspected March 22d; A. G. S.—The mines were idle, hence measurements of air could not be made. The 1st Left was too wet, and a rear break-through needed closing. The roof was bad and needed attention at about 100 feet back from head of the entry. The Main entry was also too wet, the pump not having sufficient capacity to keep it well drained.

1902.—Inspected September 26th; A. G. S.—The mine was not properly ventilated. The current did not reach the working faces, due in part to rotten and leaky brattices and seemingly in part to lack of horse-power at the furnace.

1902.—Inspected December 8th; A. G. S.—Ventilation was still defective. The furnace, so to call it, was unable to furnish the requisite volume of air. Said "furnace" had neither arch nor walls. Instructions were given to provide a fan or adequate furnace.

MT. MORGAN MINE.

Mine Office, Williamsburg.

Transportation, L. & N. Railroad.

Operated by the Mt. Morgan Coal Co., J. P. Mahan, President; T. B. Mahan, Vice-President; S. E. Mahan, Secretary and Treasurer.

The mine is ventilated by a 10-foot fan installed in 1897. About 75 per cent. of the output for 1902 was machine mined. The coal-cutting plant consists of one 20 by 20 Norwalk compressor; fourteen Harrison pick machines (5 "GGG" and 9 "HH"), and one Jeffrey air chain breast machine. On June 1, 1902, a 16-ton H. K. Porter steam locomotive was added to the mine plant.

The mine was inspected twice in 1901, by C. W. Logan, and three times in 1902.

1901.—Last inspected September 5th. The notice is: "The customary strict attention given to brattices, etc., was rather lax, owing to unavoidable conditions. However, quite an abundant air volume was entering the mine to provide good ventilation, and with minor improvements made as suggested mine boss, no doubt splendid ventilation will result. Conditions otherwise fair."

1902.—Inspected March 26th; A. G. S.—The mine was in good condition, except that on the 5th entry, a curtain was needed, below the cross entry, and brattices on worked-out rooms needed repairing.

1902.—Inspected September 29th; A. G. S.—The ventilation of the bank was altogether unsatisfactory. There was not sufficient air entering the bank, and the current was not so conducted as to serve all the working places. On entry 3 where there should have been 6,200 feet of air, there was a volume of less than 1,800. In No. 4 and No. 5 there was not enough to give a measurement. In No. 7 only 712 feet could be found.

1902. Inspected December 11th; A. G. S.—Ventilation, drainage and timbering were all satisfactory.

PINE KNOT (STRUNK) MINE.

Mine Office, Strunks.

Transportation, Cincinnati Southern Ry.

Operated by the Pine Knot Coal Co., A. McDonald, Manager.

A new mine was opened by this company during 1902. The old mine was abandoned July 25th, and shipments from the new one were begun on August 12th. Another new mine opening will be made during 1903, at which a new hoisting rig will be erected. A mile of new track will be built.

The old mine was inspected once and the new one once in 1901, by Mr. C. W. Logan. The new mine was inspected twice in 1902.

1901.—The new mine was inspected November 14th. The notice is: "Excepting a few brattices needed and some curtains repaired, as indicated Mr. Swift, all essential conditions are satisfactory. (This is a new mine.)"

1902.—Inspected May 2d; A. G. S.—Ventilation was defective. The intake of air was abundant, but the current was not well conducted to the faces. Drainage and timbering were good.

1902.—Inspected August 6th; A. G. S.—Ventilation was not satisfactory in either No. 1 or No. 2 opening. The working faces were practically without ventilation.

PROCTER, GRINSTEAD AND KLONDYKE MINES.

Mine Office, Red Ash.

Head Office, Williamsburg.

Transportation, L. & N. Railroad and Southern Ry.

Operated by the Procter Coal Co., H. F. Finley, President and General Manager; F. W. Finley, Secretary and Treasurer; Philip Francis, Superintendent. Mine Foremen: J. W. Williams, at Procter mine; Mitchell Cecil, at Grinstead mine; J. H. Hall, at Klondyke mine.

During 1901 and until June 10th, 1902, the "Klondyke" opening was operated on lease by Jno. W. Ratcliff.

The Procter, Grinstead and Klondyke were each inspected twice

in 1901, by C. W. Logan. Mr. Stone's visit to the Procter and Grinstead in December is noted in his memorandum during December 20th, under Dowlais mines. The Procter and Grinstead mines were inspected thrice and the Klondyke twice in 1902.

PROCTER MINE.

1901.—Last inspection was made September 6th. The notice is: "Nineteen thousand eight hundred (19,800) cubic feet air per minute was entering the mine to ventilate the 125 persons working inside, and its conduction to working faces was reasonably fair, excepting 3d and 4th Right entries off 1st Left Main entry, where natural means was the air dependence. But a door on 1st Left Main, below 3d Right entry, and a furnace built on 4th Right near head, with 1st Left Main entry cleared out to outside and utilized as an air intake way, ventilation will be good. Conditions in other respects good as expected."

1902.—Inspected March 21st; A. G. S.—"Conditions generally good."

1902.—Inspected September 24th; A. G. S.—On account of poor condition of a curtain for 2d Right entry and its air-course, the ventilation of said entry was deficient. In other respects the condition of the bank was satisfactory.

1902.—Inspected December 5th; A. G. S.—The bank was practically without ventilation, there being no current sufficient to be measured by an anemometer.

GRINSTEAD MINE.

1901.—Last inspection was made September 6th. The notice is: "Mine was idle and very thorough air determinations could not be made. However, it was readily discovered that the return air-way was entirely too small to allow adequate air-volume to traverse same to properly ventilate the mine, though when connection between 1st Left and Evans entry off South Main entry is made (in about 300 feet) it will complete a thorough permanent re-

turn air-way to fan. So said Mr. Ballou, and no doubt will provide good ventilation. Other inside conditions were satisfactory."

1902.—Inspected March 21st; A. G. S.—"The mine was in very good condition."

1902.—Inspected September 24th; A. G. S.—Although an abundance of air was entering the mine, it was not properly ventilated, in consequence of failure to make provisions for sending the air into all the working places.

1902.—Inspected December 5th; A. G. S.—The same complaint as in September is made.

KLONDYKE MINE.

1901.—Last inspection was made September 6th. The notice is: "Thirty persons work inside. 11,800 cubic feet air per minute returning to furnace, and with some doors on 1st Left and a door located to ventilate Left entry off 1st Right, as talked with Superintendent, its condition will be good. Drainage just fairly good. Propping and timbering adequate."

1902.—Inspected September 24th; A. G. S.—An abundance of air was entering the bank, but it did not ventilate the workings on 1st Right and Main entries.

1902.—Inspected December 6th; A. G. S.—Conditions were still defective; although plenty of air entered the bank, it was not carried into the working places and within legal distance of the faces.

TOW WAD MINE.

Mine Office, Pine Knot.

Transportation, Cincinnati Southern Ry.

C. C. Cordell & Co., Lessees.

This mine was not inspected in 1901. Two inspections were made in 1902, on May 1st and August 5th. On both occasions it was in bad condition, as regards both ventilation and drainage.

WATTS CREEK MINE.

Mine Office, Wofford.

Telegraph Office, Williamsburg.

Transportation, Louisville & Nashville Railroad.

Operated by the Watts' Creek Jellico Coal Co., C. W. Evans, President and Secretary; I. N. Cook, Superintendent and mine foreman.

This mine was opened about July 1, 1901. No inspection of it was made in that year. Mr. G. W. Stone's visit is noted in his memorandum of December 20th, under the Dowlais mines. Three inspections were made in 1902.

1902.—Inspected March 27th; A. G. S.—There was practically no ventilating current entering the mine. There was hardly any fire in the furnace so-called.

2. Inspected September 29th; A. G. S.—The only work was on the Main entry. A current of 5,554 feet was entering the bank, but was lost before it reached the head of the Main. All rooms on the left had been driven up 70 to 120 feet, and no break-throughs made, hence, were without ventilation.

3. Inspected December 10th; A. G. S.—The mine was practically without ventilation. A new air-shaft had been completed, but was not yet connected with the workings. With the connection made and a proper furnace built for it, the mine should be readily ventilated.

WEST JELICO MINE.

Mine Office, Strunks.

Transportation, Cincinnati Southern Ry.

Operated by the West Jellico Coal Co., W. E. DeLaney, President; R. T. McKeen, Vice-President; O. H. Kecton, Secretary; A. T. Siler, Treasurer; J. N. Sharp, Attorney. Mine foreman, Joe Graef.

This mine was opened in the early part of 1901, the first shipments being made April 1st of that year. It is connected with the main line of the Cincinnati Southern by a spur track 1,300 feet

long. The entrance to mine is by a slope of 22 degrees, 40 feet long, the total length of the incline from the knuckle at the tip-house to the bottom of the slope being 117 feet. The plant includes a double-gearred hoisting engine (hoisting five tons per trip up the slope, using single rope); a shaker screen and engine for same and a set of Fairbank's scales.

The mine was inspected twice in 1901, by C. W. Logan, and twice in 1902.

1901.—Last inspection was made November 15th. The notice is: "All conditions good."

1902.—Inspected May 2d; A. G. S.—The intake of air was insufficient, for which there were two reasons, namely, (1) an open break-through, which allowed the air to escape to some old workings, and (2) not sufficient draught at the furnace, in consequence of the absence of grate-bars.

1902.—Inspected August 6th; A. G. S.—A volume of 7,920 cubic feet of air was entering the mine, not quite enough for the 88 persons underground, and this was lost before it reached the head of 1st Left entry. A door was needed on the Main, just beyond the mouth of 1st Left. On the Straight entry 6,553 cubic feet of air was found when the total volume for the mine (not less than 8,800 feet) should have been traveling. It is evident that the ventilation of the bank had been improved, but it was still defective.

WESTERN DISTRICT.

The following counties, producing commercial coal in 1902, lie within this district: Butler, Christian, Daviess, Hancock, Henderson, Hopkins, McLean, Muhlenberg, Ohio, Union, Webster.

Output of bituminous coal in 1902, tons3,644,315
 Total tons shipped from the mines in 19023,354,402
 Production of coke in 1902, in tons 51,655
 Employes for 1902: Maximum, 5,477; average 5,123
 Average number of days worked in 1902 194

Butler County.

The output for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
West Aberdeen	4,847.24	1,165.00	1,168.00	7,180.24
Aberdeen	2,040.00	606.00	279.00	2,925.00
Total	6,887.24	1,771.00	1,447.00	10,105.24

ABERDEEN MINE.

Mine Office, Morgantown.

Transportation, Green River.

Operated by B. Baker, Lessee of Aberdeen Coal & Mining Co.

As is indicated by the output, the mine was operated only in a small way during the year, and operations were not continuous.

The mine was inspected once in 1901, by Mr. Logan (May 24th), at which time "work was confined to robbing pillars and stumps, and all essential conditions (found) reasonably good." The mine was visited April 15, 1902. Work was still on pillars and stumps, and only four persons employed underground.

WEST ABERDEEN MINE.

Mine Office, Aberdeen.

Transportation, Green river.

Operated by the West Aberdeen Coal Co., James F. Phillips, President; T. E. Fuller, Secretary and Treasurer.

The mine was inspected twice in 1901 by C. W. Logan, though in each instance the bank was idle. In 1902 the mine was inspected once, though idle at the time. Indeed, operations in 1902 were rather spasmodic, and consisted chiefly of drawing pillars and stumps. The mine is about done and another bank is being opened.

1901.—Report of last inspection, October 31st, is: "Mine was idle and no one was inside. Furnace needed cleaning out to produce stronger air-draught. Work principally is confined to pulling pillars on Main, 1st and 2d Left entries, with about fifteen miners. From appearance of brattices, etc., and considering character of work, there is no reason why ventilation should not be fairly good, and it is the Inspector's belief that it is. Conditions otherwise good. Two miners, Neler Herrel and A. C. Cox, extended the requested courtesy of accompanying me, in absence of mine officials."

1902.—Inspected April 15th; A. G. S.—The mine was idle, but the indications were that with a fire in the furnace the bank would be satisfactorily ventilated. Drainage and timbering were good.

Christian County.

The output, in tons, of the one commercial mine in this county for 1902, according to classes, was as follows: Lump, 15,745; nut, 4,152; miscellaneous, 66,556. Total, 86,453 net tons.

EMPIRE MINE.

Mine Office, Empire.

Head Office, Nashville, Tenn.

Transportation, L. & N. Railroad.

Operated by the Empire Coal & Mining Co., J. D. Anderson, President; H. W. Buttorff, Vice-president; C. H. Dezevelos, Sec-

retary; W. T. Rutland, Treasurer and General Manager (Empire). Mine foreman, James A. Bowie.

This mine is ventilated by a 10-foot Crawford & McCrimmon fan (Brazil, Ind.), installed in 1896. All the coal is mined by electric machines, four Morgan-Gardner and three Jeffrey machines being in service. During the year, the following were installed: A new Jeffrey switch-board; a Skinner engine, 110 horse-power, and a 75 H. P. generator.

The mine was inspected twice and visited once without inspection in 1901, by G. W. Stone. Two inspections were made in 1902.

1901.—Last inspection was made September 17th. The report is: "The mine was found throughout to be in most excellent condition, worthy of special praise."

Memorandum as to visit in December by G. W. Stone, dated January 4, 1902: "December 28th and 29th, the mines at Empire and Sebree visited and conditions inquired into, and all conditions reported good. Not inspected on account of bad weather and bad state of health."

1902.—Inspected May 20th; A. G. S.—The mine was in good condition.

1902.—Inspected October 21st; A. G. S.—An ample volume of air was entering the bank, but it did not reach all the working places. On the 3d West the current was too weak for measurement.

Daviess County.

The output, in tons, of commercial coal for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
New Holland	5,678.00	265.00	2,598.00	8,541.00
Owensboro C. & M.	313.93	130.13	452.14	896.20
Total	5,991.93	395.13	3,050.14	9,437.20

NEW HOLLAND MINE.

Mine Office, Owensboro.

Transportation, Louisville, Henderson & St. Louis Railroad.

Operated by the New Holland Coal Co., Guy M. Deane, President; D. Stewart Miller, Secretary and Treasurer.

The mine was inspected three times in 1901 by C. W. Logan. The mine was operated in a very desultory fashion in 1902—idle much of the time.

1901.—Last inspection was made November 26th. The notice is: Ventilation reasonably good. Drainage satisfactory. No immediate neglect to support roof on entries or in rooms observed.

1902.—Two visits were made to the mine; on May 29th, when it was idle and had been for two months, and on September 15th, when it again was idle.

OWENSBORO MINE.

Mine Office, Owensboro.

Transportation (from Owensboro), Louisville, Henderson & St. Louis Railroad and L. & N. Railroad.

Operated by the Owensboro Coal & Mineral Co., W. S. Morrison, President; H. A. Williams, Vice-president; H. W. Baker, Secretary and Treasurer. Mine foreman, James Gillin.

This mine, which was opened in 1901, has no railroad connection, hence operations are dependent upon the condition of the roads, and are irregular. In January, 1902, 17 persons were em-

ployed inside, but during nearly all the year there were usually less than 6 persons underground at such times as the bank was operated. The mine seems to have escaped the attention of the office in 1901.

1902.—On May 29th, when the bank was inspected, only three persons were employed inside. Conditions were good. On September 15th only two men were employed inside.

Hancock County.

The output for 1902, in tons, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Falcon	4,206.90	556.00	1,602.00	6,364.90
Auburn Ash	3,254.87	818.47	1,017.35	5,090.69
Total	7,461.77	1,374.47	2,619.35	11,455.59

AUBURN ASH MINE.

Mine Office, Fenley.

Head Office, Louisville, Ky.

Transportation, Louisville, Henderson & St. Louis Railroad.

Operated by the Auburn Ash Coal Co., Attila Cox, President; R. N. Hudson, Vice-president (Cloverport); Geo. H. Lamkin, Secretary.

This mine, which consists of three drifts, was opened in 1901, but no shipments were made until October, 1902, the work up to that time having been altogether in the nature of development. It is connected with the main line of the Louisville, Henderson & St. Louis railroad at Lewisport by a spur four miles long, which was completed about October 1st. The coal is about 4 1-3 feet

thick, and is considered to be the equivalent of that worked at the Falcon mine.

The mine was inspected October 18, 1902, by A. G. Spillman. The three openings are known, respectively, as the Dorsey, the Random and the Virginia. The first two are driven through from daylight to daylight. At the time, natural means were depended on for ventilation. A total of 14 men were employed underground, the greatest number in any one opening being six.

FALCON MINE.

Mine Office, Adair.

Transportation, Louisville, Henderson & St. Louis Railroad.

Operated by M. H. Enright.

The mine has been worked down to a few stumps and pillars, and is expected to be exhausted by July 1, 1903. A new mine is being opened, which is expected to be ready for shipment by the autumn of the present year (1903).

The mine was inspected three times in 1901 by C. W. Logan. Two inspections were made in 1902.

1901.—Last inspection was made November 26th. The report is: "All things considered, essential conditions were satisfactory."

1902.—Inspected May 10th; A. G. S.—Ten persons were employed inside. All work was on pillars and stumps. Except at a point on the Main, where some dangerous top needed attention, general conditions were satisfactory.

1902.—Inspected September 11th; A. G. S.—A few men were engaged in drawing the pillar between Main entry and air-course, preparatory to abandonment of the mine. All requisite safeguards against accidents from falls seemed to be taken.

Henderson County.

The output for 1902, in tons, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Henderson	2,089.60	700.33	9,370.69	12,160.62
Rankin	7,690.00	3,460.00	4,553.50	56,685.50
Peoples'	3,454.50	934.50	4,356.00	8,755.00
Baskett	22,474.68	5,459.05	33,973.35	61,907.08
Corydon	4,957.00	950.00	1,142.00	7,049.00
Total	40,665.78	11,503.88	94,387.54	146,557.20

BASKETT MINE.**Mine Office, Baskett.**

Transportation, Louisville, Henderson & St. Louis Railroad.

Operated by the Pittsburgh Coal Co., Alexander Blair, General Superintendent; Mrs. T. C. Blair, Manager and Buyer. Mine foreman, John Blair.

The mine (a shaft) is ventilated by a 10-foot Brazil fan, installed in 1896.

The mine was inspected three times in 1901 by C. W. Logan, and twice in 1902.

1901.—Last inspection was made November 28th. The report is: Quite a serious squeeze has occurred on 1st Left entry on south side, which is temporarily affecting ventilation. However, the plan now being pursued to practically overcome same is good, and will, no doubt, prove satisfactory. Otherwise conditions fairly good.

1902.—Inspected May 27th; A. G. S.—The mine was in good

condition. The presence of fire-damp in the mine was noted, and the company was warned to keep dusty parts of the mine well sprinkled.

1902.—Inspected September 11th; A. G. S.—Ventilation and drainage in rooms were satisfactory, but timbering in rooms was defective, props being too far back from faces. Props without caps were noticed.

CORYDON MINE.

Mine Office, Corydon.

Transportation, Ohio Valley R. R.

Operated by the Corydon Coal Co., W. H. Lloyd, Proprietor.

The mine (a shaft) is ventilated by a 4-foot fan, made by the Corydon Coal Co., which was installed in 1902.

The mine was inspected twice by C. W. Logan, and visited once without inspection by G. W. Stone, in 1901. In 1902 it was inspected once and visited without inspection once.

1901.—Visit by Mr. Stone was made October 24th. No inspection deemed necessary. Second inspection, by Mr. Logan, was made November 29th. The notice is: "Excepting an air obstruction in Main entry blind near face, that was ordered removed, conditions in general were satisfactory."

1902.—Visited May 26th. The mine was idle, having been shut down while a new fan was being put in. Inspected September 10th. Ventilation was not satisfactory; the quantity of air entering the bank was too small, and there was too much waste left in break-throughs for the current to properly travel the rooms.

HENDERSON MINE.

Mine Office, Henderson.

Transportation, Louisville, Henderson & St. Louis R. R. and L. & N. Railroad.

Operated by the Henderson Mining & Manufacturing Co., O. W. Rash, President; Chas. E. Dallam, Vice-president; H. J. McAvoy, Secretary and Treasurer.

The mine (a shaft) is ventilated by a 10-foot fan, installed in 1884.

Inspected three times, by C. W. Logan, in 1901. One inspection and two visits were made in 1902.

1901.—Last inspection was made November 29th. The notice is: "Ventilation satisfactory. Props not close enough to working-room faces. No dangerous neglect to timber entries observed. Drainage good."

1902.—Inspected May 26th. Ventilation was good. The Main entry was too wet and muddy. The top on 3d Left and 4th Left needed attention. The mine was visited August 27th, but was temporarily idle. It was again idle September 10th.

PEOPLES' MINE.†

Mine Office, Henderson.

Transportation, L. & N. Railroad.

Operated by the Peoples' Mining Co., J. E. Hosbach, President; Frank Rhinehart, Secretary and Treasurer; George Fulner, Superintendent and mine foreman.

The mine (a shaft) is ventilated by a 6-foot fan, made by the Peoples' Mining Co.

The mine was inspected twice and visited once, without inspection, by C. W. Logan, in 1901. Two inspections and a visit were made in 1902.

1901.—When visited in October, by Mr. Logan, repairs were being made to the hoisting rig. The head sheave had broken, and the cage, which was half-way up, fell to the bottom, resulting in complete destruction of the cage. This matter is noted here, because it serves as a distinct warning that safety-catches on cages must receive constant attention. Had the catches and guides been in good condition the cage ought not have gone to the bottom. Last inspection was made November 27th. The notice is: "Ventilation fairly good. 3,600 cubic feet air per minute, entering the mine for the ten persons employed therein, and its conduction to

working faces is reasonably good. Much needed timbering has been done on main entry, but more is needed where indicated bank boss. Drainage good."

1902.—Inspected May 26th; A. G. S.—Practically no current was entering the mine, and what did enter was lost to the return before it reached the men. A door was needed on 1st Left to replace a curtain.

1902.—When visited August 27th the mine was not running. Inspected September 10th, and all conditions found satisfactory.

RANKIN MINE.

Mine Office, Spottsville.

Head Office, Evansville, Ind.

Transportation, Green river and Louisville, Henderson & St. Louis R. R.

Operated by the Arnold Coal Co., R. C. Arnold, President; Rankin Eastin, General Manager. This company is successor to the Green River Coal and Mining Co., having purchased the property in the fall of 1901.

The mine (a shaft) is ventilated by a 10-foot Brazil fan, installed in 1896.

The mine was inspected four times by C. W. Logan, in 1901, and twice in 1902.

1901.—Last inspection was made November 27th. The notice is: "Conditions governing ventilation not bad. However, with East entry off 1st North driven direct through to fan-shaft, ventilation should reach a very high plane of excellence. Timbering, propping and drainage, good."

1902.—Inspected May 27th; A. G. S.—The mine was in good condition.

1902.—Inspected September 13th. The current entering the bank was more than sufficient, but the air did not reach all the working faces.

Hopkins County.

The output in tons for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Crabtree	8,964.20	2,940.00	85,570.50	97,474.70
St. Charles	29,729.00	12,118.00	92,777.00	134,624.00
Carbondale	3,638.57	1,645.00	33,681.54	38,965.11
Earlington 11 .....	.....	.....	147,747.00	147,747.00
Earlington 9	116,554.00	26,804.00	59,082.00	202,440.00
Hecla	115,935.00	22,583.00	7,062.00	86,290.00
Arnold .....	.....	.....	146,489.00	146,489.00
Diamond	20,101.00	5,103.00	112,267.00	137,471.00
Barnsley	5,801.00	3,244.00	72,895.00	81,940.00
Reinecke	61,022.00	36,539.00	174,445.00	272,006.00
Victoria	6,945.14	2,045.02	94,584.94	103,575.10
Oak Hill	13,784.57	5,834.50	47,497.83	67,116.90
Nortonville .....	.....	.....	75.00	75.00
Totals	289,122.48	103,334.52	1,153,401.81	1,545,858.81

ARNOLD MINE.

Mine and Head Office, Earlington.

Transportation, L. & N. Railroad

Operated by the St. Bernard Coal Co. (See Earlington No. 9.)

Mine foreman, John Rule.

The mine (a drift) is ventilated by a 16-foot fan made at the shops of the company. The entire output of the mine is mined

by air machines, all punchers, of which there are the following: Ingersoll-Sergeant H4, 3 machines; Harrison HHH, 3; Harrison GGG, 3. Three Jeffrey-Legg air drills are used. The compressed air plant, which also supplies air for Barnsley, consists of 1 Ingersoll-Sergeant straight line compressor, class A, 22 by 22¼ by 24, of 192 horse power; and one 20 by 20¼ by 24, of 160 horse power.

The mine was inspected twice by G. W Stone, in 1901, and twice in 1902.

1901.—Last inspection was made September 9th. The notice is: "Ventilation very defective on East 1st and 2d entries, and also in head North workings, caused by leakage of two-thirds or more of the air volume on the Main at mouth of the 4th South, and just below 5th South entries. To remedy this, a door was ordered at mouth of 4th South on East 4. Otherwise the mine was in excellent condition.

1902.—Inspected April 18th; A. G. S.—The current entering the mine was very irregular, due to the fan being hitched on to the shaker shaft, and, consequently, varying in speed with the shaker. With air-shaft completed between South 5 and 6, and fan run by a separate engine as proposed, ventilation should be all right.

1902.—Inspected October 22d; A. G. S.—All conditions were satisfactory.

BARNSLEY MINE.

Mine Office, Barnsley.

Head Office, Earlington.

Transportation, L. & N. Railroad.

Operated by the St. Bernard Mining Co. (See Earlington No. 9.) Mine foreman, Rousseau O'Bannon.

A few diggers are employed at this mine, but practically it is a machine mine. Ventilation is secured by means of a furnace. The mining machines used air: 4 Harrison, "A" type, and 2 Harrison, "Standard."

The mine was inspected twice in 1901, by G. W. Stone, and twice in 1902.

1901.—Last inspection was made September 9th. The notice is: "I note the excellent drainage of mine in 2d hill, and transfer of force to that hill, and that the work and indications point to a dry mine very soon. Drainage not bad now. Ventilation good. First hill: All mine conditions good."

1902.—Inspected April 19th; A. G. S.—All conditions good in both mines.

1902.—Inspected October 22d; A. G. S.—In 1st Hill conditions were satisfactory. In the 2d Hill the current entering bank was not quite enough, and the air did not reach all the working faces.

CARBONDALE MINE.

Mine Office, Hamby Station.

Transportation, Illinois Central R. R.

Operated by the Carbondale Coal and Coke Co., Brack Owens, President (Paducah); Samuel McElfatrick, Secretary (Princeton); Edw. Garrett, Treasurer (Princeton). Mine foreman, John Palmer.

For the first four months of the year the mine was operated by Mr. W. E. Booth, lessee. On April 30th Mr. Booth surrendered his lease, and the company, as above, took charge.

The mine was inspected twice, by G. W. Stone, in 1901. In 1902 one visit without inspection and one inspection were made.

1901.—Last inspection was made September 6th. The notice is: "Your mine was found to be in most excellent condition in all respects."

1902.—The mine was visited May 21st but was idle. Not much was done at the mine during said month. Inspected September 4th; A. G. S.—A sufficient volume of air was entering the bank, but it was not properly distributed. Attempts to get measurements on entries 7 and 8 West and 1 Right failed because of weakness of the current. The horse power of the furnace seemed inadequate for the mine.

CRABTREE MINE.

Mine Office, Ilsley.

Telegraph Office, Dawson.

Transportation, Illinois Central R. R.

Operated by the Crabtree Coal Mining Co., A. Howell, President (Clarksville, Tenn.); Edward Isley, Vice-President (Philadelphia, Pa.); R. M. Salmon, Secretary and Treasurer (Ilsley). Mine foreman, John Harland.

Ventilation is secured by means of furnace. Practically all the coal is mined by machine, 10 Harrison machines being used. The power plant consists of two 100 horse-power and one 60 horse-power tubular boilers, and one 20 by 22 by 24 Norwalk compressor.

The mine was inspected twice by G. W. Stone, in 1901, and two inspections were made in 1902.

1901.—Last inspection was made September 6th. The notice is: "I found your mine throughout to be in most excellent condition."

1902.—Inspected May 21st. The intake of air was not sufficient—only 6,204 feet for 81 persons. Sufficient air was not traveling the rooms on 6th East, 8th East and 10th West entries.

1902.—Inspected September 4th. An ample volume of air was entering the bank, but it did not properly travel all the working places. On the 7th East the current was too weak in the working places to afford a measurement.

DIAMOND MINE.

Mine Office, Morton's Gap.

Head Office, Earlington.

Transportation, L. & N. Railroad.

Operated by the St. Bernard Mining Co. (See Earlington No. 9.) Superintendent at Mines, F. B. Harris. Mine foreman, James Blanks.

Ventilation is secured by means of a 15-foot fan, made at the shops of the company. All the coal is made by machine, 12 Harrison punchers being used, consisting of the following types: 1 "W,"

2 "Standard," 1 "G," 2 "GGG," 6 "A." Air is supplied by a Norwalk compressor, 22 by 24, of 200 horse power. An H. K. Porter 10-ton steam locomotive is used for outside haulage. Tailrope is used for haulage on the Main entry.

The mine was inspected twice in 1901, by Mr. Logan in May and by Mr. Stone in September. Two inspections were made in 1902.

1901.—Last inspection was made September 10th. The notice is: "Just as I got to the head workings, the rope that runs the fan broke, and stopped the air current. But for this, the mine appeared to be in good condition. The fan is an 8-foot one, and is to be replaced by a 15-foot one, which will give splendid air to all the mine.

1902.—Inspected April 22d; A. G. S.—The mine was in good condition.

1902.—Inspected August 29th. Except on 7th South, where ventilation was defective, the mine was in good condition.

EARLINGTON NO. 9 MINE.

Mine and Head Office, Earlington.

Transportation, L. & N. Railroad.

Operated by the St. Bernard Mining Co., John B. Atkinson, President; George C. Atkinson, Secretary and Treasurer; W. Gordon, Assistant Manager; Frank D. Rash, Mining Engineer. Mine foreman, George Wyatt.

The mine (entered by slope) is ventilated by a 16-foot fan, made at the shops of the company. All the output is got by machine. Inside haulage is in part by tailrope and in part by electric motor, the trains being brought to bank by tailrope. The power plant consists of the following: 2 Ingersoll-Sergeant straight line compressors, class "A," one of 192 horse-power and one of 160 horse-power; one Norwalk compound compressor, 24 by 30, of 250 horse-power, 1 75 horse-power automatic Ball engine; 1 75-K. W., 250-volt generator, made by the Kester Electric Co., supplying current for No. 9 motors. The mining machines consist of 10 Harrison

"GGG" machines, 1 Sullivan, 2 Ingersoll H4 machines, and 4 Jeffrey-Legg air drills. The motors used for inside haulage are 1 Jeffrey 10-ton, No. 493, electric locomotive, with two motors rated at 40-h. p. each; and 1 40-h. p. stationary motor, for rope haulage. (The winding drum for the rope which brings the trains to surface is driven by steam.)

The mine was inspected twice in 1901 by C. W. Logan. In 1902 two inspections were made.

1901.—Last inspection was made October 8th. The notice is: "Drainage satisfactory. No dangerous neglect to post rooms or timber entries observed. Twelve thousand two hundred and fifty (12,250) cubic feet air per minute was entering the mine to ventilate 100 persons working therein. However, its conduction to workings was defective, as follows: Air current near head of 4th West entry insufficient, and door near entry-mouth needs repairing; also curtain was ordered re-hung on entry between rooms 8 and 9. Mine boss was instructed to substitute a door for the defective curtain on Main South entry below 4th West, to force a stronger air-volume into 3d East entry blind to ventilate 15 persons working therein. Door on Main South entry, between 1st East blind and 2d East entry, stands badly in need of repair to increase the air-volume intended for 2d East workings, and with the curtain between rooms 63 and 64 hung, and the plan carried out to ventilate this workings as explained by mine boss, no doubt an air betterment will result. 1st East entry blind between room 65 haulway and face needs attention, as discussed with bank-boss. Much slate has fallen in same. Measurement of 22,960 cubic feet return air per minute was taken, hence it is believed that the fan has ample power to properly ventilate the mine with air leakages remedied, and it was observed that the remarkable difference in the intake air volume and return current of air was principally due to the bad condition of Main South entry door above 1st East, which was being repaired. I trust this matter will receive your earnest and vigorous attention."

1902.—Inspected April 21st; A. G. S.—"All general conditions good."

1902.—Inspected August 30th; A. G. S.—The ventilating current was short on the 3d East, and in last break-through of the 4th West it was too weak to afford a measurement. Otherwise the mine was all right.

EARLINGTON No. 11.

Mine and Head Office, Earlington.

Transportation, L. & N. Railroad.

Operated by the St. Bernard Mining Co. (See Earlington No. 9.) Mine foreman, John Evans.

The mine—formerly entered by drift, but now entered by shaft—is ventilated by a 12-foot fan made at the shops of the company. All coal is mined by machine, nine Harrison machines, six of the “W” type and three of the “GG” type, being used. Three Jeffrey air drills (Legg type) are used. Air is supplied by compressors stationed at No. 9 mine. Outside haulage is done with two H. K. Porter 12-ton steam locomotives; inside haulage, by mules.

The mine was inspected twice by G. W. Stone in 1901. Two inspections were made in 1902.

1901.—Last inspection was made September 9th. The notice is: “An inspection of all East workings from 3d to the 10th, both inclusive, disclose most excellent conditions in all respects.”

1902.—Inspected April 19th; A. G. S.—“Conditions generally good.”

1902.—A measurement of the ventilating current was made August 22d. At this time the old furnace on East 1 was still depended upon for ventilation, the installation of the fan having been delayed. Two currents were entering the mine, one down the new shaft and one in at the drift mouth, the two meeting on No. 67 at East 4. On East 2, just outside of No. 66, where nearly all of both currents could be caught, was a volume of 5,346 feet, and on East, west of North 66, a volume of 1,822 feet was found, giving a total of 7,168 cubic feet. In view of the probable losses to

the furnace from the South workings before 66 was reached, it seemed probable that about enough air was entering the bank for the 85 or 100 persons inside, but it was evident that the furnace • was now too far away from the working faces to ventilate them properly.

1902.—Inspected October 23d; A. G. S.—The fan was in place, about ready for running, but had not yet been started, hence dependence was still on the furnace. A sufficient current was found to be entering the mine, but it did not ventilate all the working places.

HECLA MINE.

Mine and Head Office, Earlington.

Transportation, L. & N. Railroad.

Operated by the St. Bernard Mining Co. (See Earlington No. 9.) Mine foreman, Wm. Jennings.

The mine (entered by slope) is ventilated by a 12-foot fan. A few diggers are employed in the mine, but practically all the coal is machine-mined, three standard "D" Morgan-Gardner chain breast electric machines, for 5-foot undercut, being used. The trains are brought from the bottom of the slope to the tippie by tailrope. The power is supplied by one "Ideal" high-speed, automatic engine and one 75-K. W., 250-volt Sperry generator.

This mine was inspected twice in 1901 by C. W. Logan. Two inspections were made in 1902.

1901.—Last inspection was made October 7th. The notice is: Drainage, propping and timbering good. New fan is erected at old Hecla shaft, to extract from abandoned workings "black damp," and assist in ventilating this mine, but owing to much water encountered in the old works, very little of the desired results have been so far obtained, and it was explained that 6th South entry would necessarily be driven about 90 feet further before the new up-cast shaft would be made; hence condition of ventilation about the same as in former supervision, not very

good on west side, however, owing to the peculiar difficulties to contend with in the reconstruction of this mine, the betterment of ventilation is of no slight perturbation though the incomplete plans to adequately ventilate same are highly commendable, as discussed with mine boss.

1902.—Inspected April 18th; A. G. S.—“The mine was in good condition except on 2d West entry. Bad top was noted on this entry toward the face.”

1902.—Inspected October 23d; A. G. S.—A sufficient current was entering the bank, but it did not properly reach all the working places. This was especially true on the 2d West.

MONARCH MINE.

Mine and Head Office, Madisonville.

Transportation, L. & N. Railroad.

Operated by the Victoria Coal Co., James R. Rash, President; G. W. Rash, Secretary; Geo. C. Atkinson, Treasurer; W. F. Anderson, Superintendent. Mine foreman, John Carroll.

This mine was operated by the Monarch Coal Co. the larger part of 1901, and was then sold to the new organization.

The mine (a shaft) is ventilated by a 16-foot fan made at the company's shops. Practically all the coal is mined by electric machines. The machinery plant consists of: One 150 H. P. Atlas side-crank hoisting engine; one 100 K. W., 250-volt, Independent mine type generator, made by the Link-Belt Machinery Co.; five Link-Belt chain breast coal cutters, and two Goodman chain breast machines—all machines for 5-foot undercut.

The mine was inspected twice in 1901, by C. W. Logan, and twice in 1902.

1901.—The last inspection was made October 9th. The notice is: “Drainage satisfactory. No immediate dangerous neglect to support roof observed; however, some timbers should be placed near bottom of air-shaft to preclude the possibility of trouble there from falls of roof; and 1st East air-way needs attention, as

instructed mine boss. Very little difference in the present condition of this mine and date of my former inspection (May 2d) is observed, excepting a larger fan has been placed on north side of shaft to ventilate 1st East entry, which is temporarily idle, though Mr. Anderson assured me it would immediately be started up, and the air-current being forced into the mine is strengthened to 23,560 cubic feet per minute, for 80 persons' ventilation. Defective curtains on Main South entries must be replaced by secure brattices and doors to throw adequate air volume into head East and West entries and minimize air leakages. Check curtain on 5th East, between rooms 11 and 12, ordered, to force air within 60 feet or less of working faces, also second break-through from face of 7 and 8 East entries must be closed at once. The precautionary instructions given in notice No. 97, regarding 1st and 2d East entries are essentially important, and I trust you will show them to Mr. Hulton, mine boss, in connection with this report."

The "precautionary instructions" referred to by Mr. Logan in the foregoing are as follows:

1. See that a competent person examines every morning and afternoon with a safety lamp, room 36 between 2d and 3d East entries, to see if any gas is encountered from the squeeze, also take especial pains to comply with the law in regard to examining all working places with a safety-lamp every morning, as prescribed by section 10.

2. Allow no blasting to be done except after all persons other than those whose purpose it is to fire the shots, have left the mine.

3. Beware of blown-out shots, and see that no shooting is done "on the hard."

4. Have all the blasting done by persons especially employed for that purpose.

5. Restrict persons promiscuously wandering through the mine, and allow no one to enter any entry, except where business so directs him.

6. Guard against any one with naked lights entering any place on 3d East entry below room 38.

1902.—Inspected May 29th. A great deal of work had been done since January 1st, by the new company, toward putting the mine in safe and satisfactory condition, but there was much yet to be done. The ventilation of the working portions of the East side was fairly good, although there were considerable losses of air, and there were several rooms on the 6th and 8th East entries which were not receiving enough air. On the West Side conditions were bad. On the 6th West there was practically no current passing through the last break-throughs of the rooms from 10 up to and including 17 (fire-damp was present in quantity in old 17), and between rooms 19 and 20 there was practically no current. On the 8th West, the faces of several rooms were too far ahead of the air, and the current passing through them was weak. Rear break-throughs between 6 and 7 needed closing. Fire-damp was lively in room 7. The betterment of the mine was being pushed at the time the inspection was made.

At the time of the inspection the fan was putting in 18,016 cubic feet of air. Mr. F. D. Rash, Mining Engineer for the company, on a previous date obtained a reading of 22,223, but it is believed that it was under exceptionally favorable circumstances. But however large might be the volume of the air entering the mine, a serious defect in the ventilation of the mine is the use of a single current for the entire bank. Each side should be ventilated independently. To increase the volume of the single current means to increase velocities, and the latter can not be safely increased beyond a certain limit. Moreover, any fire-damp taken up on the East side (as the air is coursed at present) must be carried into successive working places, and on into the working places on the West instead of away from them.

1902.—Inspected August 23d. The condition of the mine had been greatly improved and brought up to a satisfactory point, except that ventilation was still by a single current, coursing as before, which the present writer can not regard as a wise method for this mine. An excellent new fan (designed by Col. Albert Toombs) had been installed. A number of readings were made to deter-

mine the volume of air sent down by the fan. Readings near the bottom of the fan shaft (subject to back lashing of the air) gave an average of 25,878 cubic feet. On the 1st East near the turn from the fan shaft gave an average of 31,480 feet. In a door frame on 2d East, where an average of 11,945 was obtained in May, the new fan gave 22,485; it may be, however, that at this time a smaller proportion of the air was allowed to go up the 1st East than before.

The following comparisons of air volumes at given points illustrate the changes that have been made since May 29th:

May 29, 80		August 28	
Place	Vol. of Air	Place	Vol. of Air
6 East	9,889	6 East	13,800
7 East	8,980	7 East	14,915
10 East	9,810	10 East	10,850
To So. Main	6,109	To So. Main	11,115
To 8 West	7,338	To 8 West	9,120

OAK HILL MINE.

Mine Office, Nortonville.

Transportation, L. & N. Railroad.

Operated by the Oak Hill Coal Co., Jabez H. Trathen, President and Treasurer; John H. Trathen, Superintendent; Mrs. Cordelia Hall, Secretary. Mine foreman, John H. Trathen.

The mine is ventilated by furnace. About seven-eighths of the coal is machine-mined. The machinery plant consists of one 120-H. P. Skinner engine; one 100 K. W. Morgan-Gardner generator; two 5-foot Morgan-Gardner electric chain machines.

The mine was inspected twice in 1901, by G. W. Stone, and twice in 1902.

1901.—Last inspection was made September 10th. The notice is: "Conditions good, except on 2d West and 2d South entries, where the ventilation was quite defective, caused by waste of air on back air-course, and which must be hunted up and remedied."

1902.—Inspected April 17th; A. G. S.—Except that the mine was too wet, its condition was good.

1902.—Inspected August 29th.—Drainage had been greatly improved, but ventilation was defective. There was practically no ventilation for the working places on East Cut-off, 4th West and 2d South.

REINECKE (EUREKA) MINE.

Mine and Head Office, Madisonville.

Transportation, L. & N. Railroad.

Operated by the Reinecke Coal Mining Co., C. Reinecke, President; I. Bailey, Secretary and Manager. Mine Superintendent, Louis Feger.*

The mine (a shaft) is ventilated by a 24-foot fan, made by the Duncan Foundry & Machine Works, Alton, Ill. This fan, which was installed in June, 1901, is the largest in the State, and was built to replace two which had been used. All the coal is mined by electric chain breast machines, of which there are seven of the Jeffrey type and two of the Link-Belt type. (In 1901 the coal-cutting machines consisted of five Jeffrey electric chain, eight

*It is with sincere regret that the writer announces the death of Mr. Feger, which occurred, after a long illness, on February 22, 1903. Mr. Feger stood in the front rank with our most capable mining men. He was an honest, simple-hearted, straight-forward man—a most excellent citizen in all respects, well worthy the confidence and esteem in which he was held by his employers and neighbors. He took great pride in his mine, and being a most industrious man he gave it unremitting attention so long as it was at all possible for him to do so. The mine having, during his illness, deteriorated from its usual excellent condition, Mr. Feger though quite ill personally took up the matter of restoring it to its normal condition, and the last word the writer had from him was a verbal message that he would "put it all right." He will be greatly missed. His successor is Mr. Emile Braun.

Jeffrey air chain and four Harrison punchers, the latter being used for tough coal.) The plant includes two dynamos of 150 amperes each, each dynamo being run by its own engine. Haulage on main lines is by a Jeffrey 15-ton electric locomotive, which is of three-motor type (each motor being rated at 40-H. P.). All hauling from the partings on cross entries to the bottom of the shaft is done with this locomotive, and the Main entry has such width and has been driven so true that a high rate of speed is maintained.

Two inspections were made by G. W. Stone in 1901, and two were made in 1902.

1901.—Last inspection was made September 7th. The notice is: "I noted the new 24-foot fan was in operation, and much improvement in the ventilation, and that further increase can be made, as may become necessary. All conditions highly satisfactory."

1902.—Inspected May 30th and 31st. The mine was in bad condition, especially on the east side. At no place was there found such a current as should be expected from the 24-foot fan, the highest reading being 18,498 cubic feet. That was on the West Side, and was found only at one place, in the 10th West. The usual readings on the West Side were from 6,000 to 7,000 feet. On the East Side the highest reading was 7,650 feet. The usual readings were less than 5,000 feet.

On the 10th West, considerable fire-damp was found in room 14. Fortunately, near this point the greatest volume of air was found.

On the East Side considerable fire-damp was found in room 18 on 10th East. A current was traveling through the break-through to 19 all right, but the break-through was narrow, and such a volume as should have been passing under the circumstances was not there. In rooms 31 to 36, inclusive, on the 8th East there was fire-damp (36 was quite gassy), and yet the highest measurement of air found on that entry was only 4,704 feet (between rooms 26 and 27), which dwindled to 4,353 feet at the break-throughs

to 7th East. In the 12th East gas was found at the face. This entry was in very unsatisfactory condition. The current was weak, the break-throughs were in bad condition and the air did not travel the rooms properly. Both rooms and entry were smoky.

In addition to the astonishingly small volume of air going through bank from the large fan, it was noted that the importance of having break-throughs large enough and clean was disregarded. The tendency was:

1. To drive a room ahead before the last necessary break-through was through.

2. To unload slate in break-throughs while they were still necessary for ventilation.

3. Not to complete break-throughs to full size. Frequently considerable bottom coal was left in them, sometimes there would be some top coal left also, and often there would also be coal piled in front of them.

The same error is now made in this mine (in view of the existence of fire-damp in it) that was noted with respect to the Monarch, namely, using a single current for the entire mine. Formerly, if the writer remembers correctly, each side was ventilated independently.

1902.—Inspected October 24th; A. G. S.—The condition of the mine had been considerably improved, but it was still defective. Nothing like such a volume as should come from the 24-foot fan was going through the mine.

ST. CHARLES MINE.

Mine Office, St. Charles.

Head Office, Earlington.

Transportation, Illinois Central R. R.

Operated by the St. Bernard Mining Co. (See Earlington No. 9.) Mine foreman, George Faults.

The mines are ventilated by furnaces. Practically all the coal is machine-mined, 13 Harrison pick machines, type "A." be-

ing used. Power is furnished by two Norwalk compressors, 20 by 24, of 160-H. P. each.

Mr. Barton Crutchfield, who for nearly seventeen years was Superintendent at these mines, died October 14, 1902. Mr. Crutchfield was a man of strong personality, a loyal friend, and a kind-hearted gentleman. He was respected and esteemed by all classes of men. He had been with the St. Bernard Company for twenty-nine years, which alone attests the sterling qualities for which he was known. In addition to a personal acquaintance extending through many years, the writer was for a time associated with Mr. Crutchfield in a rather intimate way, and it is with genuine appreciation that he pays this little tribute to his memory.

A superintendent has not yet been named to succeed Mr. Crutchfield, the mines being managed from the Earlington office.

These mines were inspected twice in 1901, by G. W. Stone, and twice in 1902.

1901.—Last inspection was made September 5th. The notices are: "No. 2 mine.—I note new air shaft on 5th Right entry and improved ventilation. The mine is in a very satisfactory condition.

"The new mine.—Work much scattered. Conditions satisfactory."

1902.—Inspected May 20th; A. G. S.—St. Charles: The volume of air entering the bank (6,308 feet) was not quite enough for the 70 persons underground. On the 5th East and 7th East entries sufficient air was not traveling the rooms for the number of men in them.

South Africa.—Sufficient air was not entering the bank, and provisions for sending air through working places were not satisfactory. Stoppings were in bad order, and too much slack was allowed to remain in break-throughs.

1902.—Inspected September 3d; A. G. S.—St. Charles: All conditions were satisfactory.

South Africa.—All conditions were satisfactory.

McLean County.

The output, in tons, for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Memphis	28,748.50	7,413.00	11,074.00	47,235.50
Green River	682.16	.....	17,255.12	17,937.28
Total	29,430.66	7,413.00	28,329.12	65,172.78

FIELD MINE.

Mine and Head Office, Island.

Transportation, L. & N. Railroad.

Operated by the Memphis Coal Co., R. D. Rose, President; James Halstead, General Manager. Mine foreman, Thomas Gaddis.

This company succeeded the Field Coal Co., which formerly operated the mine, on August 1, 1901.

The mine was inspected twice in 1901, by C. W. Logan, and three times in 1902.

1901.—Last inspection was made October 29th. The notice is: "Work ceased at ten o'clock and very little fire was in furnace, and as shooting had begun, not a very thorough inspection could be made for powder fumes. Furnace needs repairing, as discussed with Mr. Gaddis, to materially improve ventilation. However, I hardly think air is very bad anywhere in this mine. Conditions otherwise satisfactory."

1902.—Inspected April 17th; A. G. S.—Very little air was entering the mine, and that little was not properly conducted. Drainage was bad.

1902.—Inspected August 28th; A. G. S.—About 2,900 cubic feet of air was passing through the furnace—not enough for the number of persons inside. The horse-power of furnace seemed inadequate.

1902. —Inspected December 13th; A. G. S. About 4,700 cubic feet of air was traveling the mine, which was insufficient for the 57 persons underground. The air-course leading to the furnace was almost closed by slate and dirt. Props were not kept close enough to room faces. Drainage still bad.

GREEN RIVER ("ISLAND") MINE.

Mine and Head Office, Island.

Transportation, L. & N. Railroad.

Operated by the Green River Coal Co., John W. Love, President; Edwin S. Randle, Secretary and Manager. Mine foreman, Thomas Blades, Jr.

This mine (a shaft) was formerly known as the Island mine. It was idle during 1901, and little was done at it until the spring of 1902, when the property was purchased by the company named above. A small amount of coal was mined in March and April, but the company was not incorporated until about May 15th. The company has opened new ground on the east side of the shaft, and has newly equipped the shaft, including new hoisting engine, new cages and a tippie with shaking screens. The new equipment was installed in September and October.

1. Inspected April 16th; A. G. S.—The mine had just resumed operations, with 9 persons underground, working on the West Side. General conditions were good. The hoisting cage was without a cover.

2. Inspected August 28th; A. G. S.—A volume of only 2,464 cubic feet of air was passing through the furnace. There was practically no current traversing the working places, and there were 41 persons underground. Drainage was bad.

3. Props were not kept close enough to room faces; otherwise conditions were satisfactory.

Muhlenberg County.

The output in tons for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Powderly	80.10	30.20	41,178.67	41,288.97
Luzerne	15,229.44	5,623.60	73,995.56	94,848.60
Pierce	15,861.00	5,094.00	51,815.60	72,770.00
Hillside .....	.....	.....	48,030.14	48,030.14
Oakland .....	.....	.....	42,549.12	42,549.12
Dovey .....	.....	.....	42,618.20	42,618.20
Crescent	5,406.00	1,466.00	144,536.00	151,408.00
Central	111,719.00	10,340.00	15,395.00	137,454.00
Bevier	14,120.00	4,450.00	79,050.00	97,620.00
Gish .....	.....	.....	423.00	423.00
Total	162,415.54	27,003.80	539,590.69	729,010.03

*** BEVIER MINE.**

Mine and Head Office, Cleaton.

Transportation, L. & N. Railroad.

Operated by the Bevier Coal Co., J. W. Bastin, President; R. S. Lytle, Secretary; Geo. Givens, General Manager. Mine foreman, James Stevens.

The mine is ventilated by a 12-foot Cole fan, made by the Cole Manufacturing Co., Washington, Ind.

The mine was inspected twice, by C. W. Logan, in 1901. Three inspections were made in 1902.

1901.—Last inspection was made September 11th. The notice

is: "Mine a little wet, but drainage not bad. Ventilation good on West Side, but defective on East Side, caused by bad stoppings, or waste at curtains, etc.

1902.—Inspected March 4th; A. G. S.—Ventilation was good. Drainage was unsatisfactory.

1902.—Inspected August 20th; A. G. S.—An ample volume of air was entering, but it was not satisfactorily distributed. Curtains were in poor condition. Drainage still unsatisfactory. Sufficient care was not taken to have props set close enough to room faces.

1902.—Inspected December 20th; A. G. S.—Ventilation was satisfactory and the drainage much improved. Props, however, were too far from room faces.

CENTRAL MINE

Mine Office, Central City.

Head Office, Louisville.

Transportation, Illinois Central Railroad and Louisville & Nashville Railroad.

Operated by the Central Coal & Iron Co., T. C. du Pont, President; S. Coleman, Secretary; Wm. D. McElhinny, Treasurer; C. B. Finley, General Manager; E. A. Foster, Superintendent.

The mine (a shaft) is ventilated by two 15-foot Brazil fans, one of them (installed in 1897) belt driven by a 60-h. p. straight line engine, installed in 1902; and one (installed in 1902) direct connected to a 20-h. p. Brazil engine. One of the fans is intended to ventilate the East Side workings and the other to ventilate the West Side. The coal is cut by hand, but the mine has electric haulage and pumping, installed in 1895. The plant includes: One 210-h. p. McEwen engine; one 135-K. W. Eddy dynamo, giving 250 volts at 800 r. p. m.; one 10-ton Jeffrey motor, for 4,000 feet haul; one 6½ by 4 Worthington-Jeffrey electric pump, and one 4 by 6 Deming-Link-Belt electric pump; one 5-K. W. "Kentucky" dynamo for illumina-

tion. The boiler battery consists of, two 72 by 16 Walton boilers, having seventy-eight 3½-inch tubes, and one 72 by 18 Walton boiler having seventy-eight 3½-inch tubes. The hoisting engines comprise a pair of 14 by 28 Brazil engines, 100-h. p., installed in 1890. The plant also includes: One No. 3 Dean Bros. boiler feed pump; one No. 8 Dean Bros. pump for drainage, located at bottom of the shaft; a 36 by 10 Link-Belt rotary slack screen and elevator; a 10-h. p. Lechner engine and Jeffrey slack conveyor, for supplying boiler fuel; a 5-foot by 12-foot Jeffrey bar screen; a "Lookout" shaker screen and weigh pan (1,000 tons daily capacity), driven by a 25-h. p. Grainger engine; one 60-foot Fairbanks standard track scales, installed in 1900; and one 5-ton Fairbanks standard platform scales. When a new head frame shall have been substituted for the present shackly affair, it should be possible to make the output of this mine 1,000 tons per day. In the present condition of the head frame, however, it would be hazardous to attempt to hoist coal at such rate.

The mine was inspected three times in 1901, by C. W. Logan. In 1902 three inspections and two partial inspections were made.

1901—Last inspection was made November 8th. The notice is: "I found your mine on both the East and West Sides in splendid condition."

1902.—February 17th. An account of the investigation of the accident which occurred in North 16, East Side, February 15th, is given in the chapter on accidents. So well as could be told at the time, the ventilating current seemed to have been traveling properly at the time of the accident, and a sufficient volume was doubtless passing.

1902.—Inspected June 12th; A. G. S.—The mine was ventilated by two independent currents, one for the East Side and one for the West Side. One 15-foot fan, situated on the East Side, was (aided a little by a steam jet) depended upon to furnish both currents, but was not equal to the task. On the East Side all conditions were satisfactory. The West Side, however, with 80 persons employed there, was in a dangerous condition. There was practically no ventilating current traversing it. Fire-damp was detected

at the head of the 2d East, on that side. Directions were given to withdraw the men from that side, in event the unsafe conditions could not be remedied at once.

1902.—Inspected August 23d; A. G. S.—The mine was found to be in good condition throughout. A special fan had been provided for the West Side.

1902.—Inspected December 19th; A. G. S.—Ventilation and drainage were excellent, but it was observed that props were not kept close enough to room faces.

1902.—Visited December 31st. It was observed that since the shaft formerly used as a second outlet was now used as the fan shaft for the East Side, it was no longer available as a second outlet. It was ascertained that another shaft was to be used, but that, although a horse-whim, cage and rope had been provided, it had not been rigged up so as to be available at all times. Request was made that the second outlet be put in lawful condition without delay. Information was subsequently received that it had been done.

CRESCENT MINE.

Mine Office, Bevier.

Transportation, L. & N. Railroad.

Operated by the Crescent Coal Co., W. R. Cole, President; A. H. Robinson, Vice-President; Frank S. Washburn, General Manager; F. P. Wright, Secretary and Superintendent of Mines. Mine foreman, Charles Hendrie.

This property was formerly known as the Memphis mine, and operated by lessees of the Memphis Coal & Mining Co. It was purchased by the Crescent Coal Co. about January, 1900.

All the coal is machine mined, and haulage is by electric motor. The plant includes six Link-Belt electric chain breast coal cutters, a 12-ton Link-Belt motor, a 190-h. p. McEwen engine, and a 125-K. W. Goodman generator.

The mine was inspected twice in 1901, once by Mr. Logan and

once by Mr. Stone, in the order named, and visited by Mr. Stone in December.

1901.—Last inspection was made by G. W. Stone, September 11th. The notice is: "You have a splendid mining plant. Mine conditions are good, except ventilation in all the head workings, Right and Left, is a little defective. A door at the mouth of the 8th West entry will remedy all this, and this should be put up at once.

1901.—The notice (124) following visit of G. W. Stone, December 5th is: "Temporary suspension on account of some injury to water pipes, etc. Merely made a visit. Conditions inquired into and reported good."

1902.—Inspected March 4th; A. G. S.—Ventilation was good everywhere, except on the 8th East, where sufficient air was not traveling the working places in consequence of the curtain at the mouth of the entry being torn. Props were too far from faces in some instances.

1902.—Inspected August 20th; A. G. S.—An ample volume of air was entering, but sufficient did not reach some of the working places. There was practically no current on the 9th East, where the total ventilating current should have been passing.

1902.—Inspected December 20th; A. G. S.—Check curtains were needed on several of the entries, since the air did not travel some of the rooms. Props were too far from faces of all rooms on the 8th East and its blind.

DOVEY MINE.

Mine Office, Mercer.

Head Office, Greenville.

Transportation, Illinois Central R. R.

Operated by the Dovey Coal Co., Mrs. Rachel McNeal Love, President; J. W. Lam, Secretary and Treasurer; William Eads, Superintendent. Mine foreman, S. A. Nolan.

This is a new mine, opened in 1901. It was visited once, in

September, and inspected once, by G. W. Stone, in 1901. Three inspections were made in 1902.

1901.—Inspection was made November 7th. The notice is: "You have a nice mine here, and everything in good condition."

1902.—Inspected March 7th; A. G. S.—Ventilation was satisfactory, and the mine was dry.

1902.—Inspected August 22d; A. G. S.—A door was required on the Main at the 1st South, and a check-curtain between first two rooms on the 1st South. Otherwise the bank was in good condition.

1902.—Inspected December 19th; A. G. S.—All conditions were satisfactory.

HILLSIDE MINE.

Mine Office, Mercer.

Head Office, Greenville.

Transportation, Illinois Central R. R.

Operated by the Hillside Coal Co., J. W. Lam, Secretary and Treasurer; William Eads, Superintendent. Mine foreman, John Garrett.

The mine is ventilated by a 12-foot fan, which is intended to also ventilate the Oakland mine.

The mine was inspected in May, September and November, 1901, by G. W. Stone. Three inspections were made in 1902.

1901.—Last inspection was made November 7th. The notice is: "Conditions very satisfactory throughout the mine."

1902.—Inspected March 6th; A. G. S.—A volume of 10,946 cubic feet of air was entering the mine, but it was not up to the legal requirement for the number of persons inside. There was hardly any current in the working places on the 5th North, and the supply for the 5th South was also deficient.

1902.—Inspected August 20th; A. G. S.—Sufficient air was entering, but on account of defective curtains did not ventilate the working places satisfactorily. On the 5th North there was practically no ventilation. The volume supplied the 5th South

was short, and a curtain was needed to direct the current through the rooms.

1902.—Inspected December 18th; A. G. S.—The intake of air was sufficient, but a number of the working places were not properly ventilated. New curtains, additional or replacing old ones, were needed on the 2d South, on the West, and on the 5th South entries. Some break-throughs needed tight stoppings. Doors were needed on the Main near 5th and 6th North entries. Cross-timbers on the lieaway, near the shaft, were broken.

LUZERNE MINE.

Mine and Head Office, Luzerne. Telegraph Office, Greenville.

Transportation, Illinois Central R. R.

Operated by the W. G. Duncan Coal Co., W. G. Duncan, President; C. W. Taylor, Vice-president and Treasurer; A. W. Duncan, Secretary. O. C. Roll, Superintendent and Mine Foreman.

This mine (a drift) began producing in March, 1901. About 45 per cent. of the output for 1902 was cut by electric machine. The plant includes five 5-foot Goodman (Link-Belt) chain breast machines, one 168-h. p. McEwen engine, and one 100-K. W. Goodman generator. The mine was visited by G. W. Stone in June, and inspected by him in September and November, 1901. Three inspections were made in 1902.

1901.—Last inspection was made November 7th. The notice is: "I found the mine in most excellent condition throughout."

1902.—Inspected March 8th; A. G. S.—The mine was in good condition.

1902.—Inspected August 23d; A. G. S.—An ample quantity of air was entering, but through losses on the way the volume of the current was not quite enough for the number of persons inside when it had reached the head of the Main, ready to go to the diggers. A considerable deficiency was noted in the 1st East.

1902.—Inspected December 17th; A. G. S.—The mine was idle and the furnace cold, hence no measurements of air could be made.

A check curtain was needed on the 2d West to send the air into the rooms, and a door was needed on the Main, beyond the Third West, to replace a curtain there.

OAKLAND MINE.

Mine Office, Mercer.

Head Office, Greenville.

Transportation, Illinois Central R. R.

Operated by the Oakland Coal Co., J. W. Lam, Secretary and Treasurer; William Eads, Superintendent. Mine foreman, W. T. Collier.

Three inspections of the mine and one visit were made by Mr. G. W. Stone in 1901. Three inspections were made in 1902.

1901.—Last inspection was made November 7th. The notice is: "The mine conditions were better than at time of former inspection and are now quite satisfactory."

1902.—Inspected March 6th; A. G. S.—The mine was in satisfactory condition.

1902.—Inspected August 21st; A. G. S.—All conditions were satisfactory.

1902.—Inspected December 18th; A. G. S.—Ventilation, drainage and timbering were satisfactory. The right-hand cage (as seen from engine room) was not safe; new catches were needed; also new guides in shaft. A new brake for the hoisting drum was needed.

PIERCE (No. 9) MINE.

Mine and Head Office, Drakesboro.

Transportation, L. & N. Railroad.

Operated by the Black Diamond Coal & Mining Co., Jas. T. Pierce, President, General Manager and Treasurer; H. W. Buttorff, Vice-President (Nashville, Tenn.); W. W. Bridges, Superintendent and Secretary.

The mine (a shaft) is ventilated by a 14-foot fan, made in the

company's shop, which was installed in 1898. A new fan engine was put in in October, 1902; also a pair of new cages. All the coal is cut by electric machine, and is brought to the shaft by electric haulage. The plant includes four Morgan-Gardner chain machines, taking from 50 to 85 amperes each, and a 10-ton Morgan-Gardner electric locomotive, which was installed January 15, 1900.

The mine was inspected in May and October, 1901, by C. W. Logan, and three times in 1902.

1901.—Last inspection was made October 29th. The notice is: "Curtains are not in good condition, and need repairing and replacing; also main return air-way on northwest side, must be cleaned out and reopened as discussed with Mr. Davis. However, the only ventilation that is really defective was discovered on West entry off 1st North, and the above improvements made, will remedy same to a great extent. At present owing to main pump being out of order, much water has accumulated in air-way near slope bottom, that temporarily somewhat stagnates air current. No neglect to post rooms or timber entries noticed.

1902.—Inspected March 5th; A. G. S.—In consequence of torn curtains the working faces on the South entry and 1st North entry were not sufficiently ventilated. Too much water was allowed to accumulate on the south. Break-throughs in use were not kept as clear of waste as they should have been.

1902.—Inspected August 19th; A. G. S.—The volume of air entering bank was not sufficient for the number of persons underground. Rear break-throughs were left open at many places, hence the current did not reach all the faces. Fire-damp in quantity was detected in the mine; the attention of the company was called to its presence, and immediate action to improve the condition of the mine was urged. On the 1st West and 1st South there was practically no ventilation. At the head of the 2d South the current was too weak for measurement. The same thing was true of the 1st and 2d North entries. In many of the rooms props were too far from faces. New guides were needed for the hoisting

shaft, the old ones being so worn as to reduce the probability of the safety-catches gripping.

1902.—Inspected October 20th; A. G. S.—The mine had been improved, but the ventilation was still defective, due rather to insufficient volume of the air entering the mine than to the distribution of it. The fan engine was in bad condition, and the fan, usually run at 109 r. p. m., was making only 50 revolutions. The 3d and 4th North entries had no measurable current traveling the working places; in the workings on other entries a current was passing, but as a rule was deficient for the reason given. A new fan engine had been ordered and was expected daily.

POWDERLY MINE.

Mine Office, Powderly.

Transportation, Illinois Central R. R.

Operated by the Central Coal & Iron Co. (See Central Mine.)

The mine (a shaft) is ventilated by a 10-foot Cole fan, direct connected to a 10-h. p. Cole engine. The hoisting rig consists of a pair of 8 by 14 Metcalf engines with drum complete. The boiler battery consists of one 38 by 24 Walton boiler having two 14-inch flues, and one of same make 40 by 26 having two 14-inch flues. The plant also includes a 10 by 8 by 14 Reilly steam pump, for drainage, located at the air shaft; a Metcalf shaker screen, of 500 tons capacity, driven by a 7 by 12 Metcalf engine; and a 5-ton "Kentucky" platform scales.

The mine was inspected in May, September and November, 1901, by G. W. Stone. Three inspections were made in 1902.

1901.—Last inspection was made November 7th. The notice is: "I note a continuation of former excellent conditions."

1902.—Inspected March 7th; A. G. S.—An abundance of air (15,680 feet) was entering the mine, but the ventilation was bad in consequence of defective curtains. Practically all the curtains in the mine were in bad shape. Because of torn curtains on the 5th

North and 2d West, the current in the 4th North was quite deficient. Drainage was bad.

1902.—Inspected August 22d; A. G. S.—Ventilation and timbering were good and drainage was improved.

1902.—Inspected December 17th. Ventilation and timbering were satisfactory, but drainage was defective.

Ohio County.

The output in tons for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Williams	8,682.52	2,105.00	61,334.40	72,121.92
Aetna Coll'y	7,222.00	2,187.00	33,610.00	43,019.00
Louise	21.00	140.00	7,536.00	7,697.00
Jamestown .....	.....	.....	12,642.00	12,642.00
Taylor	30,045.10	5,267.95	109,298.35	144,611.40
Render	58,078.30	5,033.55	43,396.26	106,508.11
Echols	11,249.00	1,597.00	50,941.00	63,787.00
McHenry	4,000.00	17,375.00	40,223.00	61,598.00
Johnson	6,975.00	1,710.00	990.00	9,675.00
Total	126,679.93	35,415.50	359,971.01	521,659.43

DEANEFIELD MINES.

Mine Office, Aetnaville.

Telegraph Office, Deane field.

Transportation, Owensboro Division of I. C. Railroad.

Operated by the Deane field Coal Co., Guy M. Deane, President: W. R. Williams, Secretary and Treasurer. Mine foreman, Henry Vogel.

The Louise mine (a slope) was idle all of 1902. It was inspected in March, October, and December, 1901, by C. W. Logan, but since it has been idle the last inspection is not reported here.

The Deane field mine (a shaft) was inspected in the months above named in 1901, by C. W. Logan. In 1902 three inspections were made.

1901.—Last inspection was made November 25th. The notice is: "The fan was temporarily still undergoing repairs, hence a poor air-determination resulted. However, Mr. Cook, mine boss, explained his intention regarding an air-course that he was making, which will materially reduce air friction and improve ventilation. Some valuable timbering has been recently done generally throughout the mine, but more was needed where indicated mine boss. Drainage reasonably fair."

1902.—Inspected May 28th; A. G. S.—There was practically no ventilation inside. Drainage of rooms on the 1st East was bad.

1902.—Inspected September 12th; A. G. S.—A larger volume of air was entering the bank than before, but otherwise there was no improvement.

1902.—Inspected October 17th; A. G. S.—An ample current was entering the mine, but it was not properly ventilating some of the working places. General conditions, however, were much better, and assurances were given by President Deane that the mine would be put in lawful condition throughout as rapidly as possible.

ECHOLS MINE.

Mine Office, Echols.

Transportation, Illinois Central R. R.

Operated by the McHenry Coal Co. (See McHenry Mine.)

Provision for ventilating the mine (a shaft) is by a small furnace, and is quite unsatisfactory. (See notes beyond.) Drainage is by a No. 7 Dean Bros. steam pump, located at the air shaft. All coal is cut by electric machine, the mine having been equipped

therefor in 1897. The mining machine plant consists of one 150-H. P., 15 by 16 McEwen engine, driving one 135-H. P. "Independent" dynamo, giving 250 volts at 600 r. p. m.; and two Jeffrey and four Link-Belt chain breast machines. The boiler battery consists of two 48 by 20 Walton boilers, having three 14-inch and two 8-inch flues. Hoisting is done with a pair of Grainger 10 by 20 engines, with drum complete. The plant also includes one 6 by 4 by 6 Dean Bros. feed water pump; one 11½ by 2 Dean Bros. feed water pump; one feed water heater complete; a Metcalf shaker screen and weigh-pan complete, having 600-tons daily capacity, which is operated by an 8 by 14 Houston, Stanwood & Gamble engine; two 60-foot Fairbanks standard track scales, and two 5-ton Fairbanks platform scales.

The mine was inspected in February and August and visited in December, 1901, by G. W. Stone. Three inspections were made in 1902.

1901.—Report of last inspection, made by Mr. Stone, in August, is as follows:

"The mine was found to be in most excellent condition generally. There was a noted improvement in the ventilation all over the mine. It was, in fact, good, and all conditions far better than ever before found. Some improvement, however, in the ventilation was needed at head of 7th and 8th (or south) entries."

Following is the notice (144) served subsequent to visit of December 27th:

"The mines merely visited, and conditions inquired into, and conditions reported good generally. No inspection was made on account of the weather and my state of health. I did not deem it safe and prudent to do so."

1902.—Inspected June 11th; A. G. S.—Sufficient air was not entering the mine. Otherwise, the ventilation would have been satisfactory. The roof on 5th North was in bad condition from mouth to face. Bad top was also noted on the 6th South.

1902.—Inspected August 27th; A. G. S.—An ample volume of air was entering the bank, but it did not reach the working faces

in sufficient quantity. In consequence of lack of check-curtains on the 5th and 7th North and 5th and 7th South, the air did not flow through a number of the rooms. The horse-power of the furnace did not seem to be equal to the demands of the mine.

1902.—Inspected November 6th; A. G. S.—Ventilation had not been improved. In order to ventilate the workings thoroughly, more check-curtains were needed than were used. Dependence was on one curtain in each entry.*

On December 18th a fan was being installed, and it is hoped that there will be no further trouble in getting the mine properly ventilated.

JAMESTOWN MINE.

Mine Office, Coffman.

Head Office, Bowling Green.

Transportation, Green River.

Operated by the Green River Mining, Manufacturing and Transportation Co., J. H. Wilkerson, President, Treasurer and General Manager; Lucian Graham, Secretary.

There are two openings (No. 1 and No. 2) at the mine. Only one was in operation during 1902, No. 1 having been abandoned early in the year.

The mine was inspected once in 1901 by C. W. Logan. Two inspections were made in 1902.

1901.—Inspection of No. 2 was made October 30th. The notice is: "This is a new mine, with four diggers, and work consists of a Main entry, in 280 feet, with 1st Right and 1st Left cross-entries just cleverly turned off same. Air shaft is opened up on 1st Left cross-entry near Main, preparatory to constructing furnace, which I don't doubt will produce adequate ventilation when completed; however, excepting Main entry face, which is stopped, pending connection of break-through, conditions regarding ventilation good as expected, all things considered. Roof well supported and water ably conducted outside."

*The matter of putting this mine in proper condition was taken up with the company vigorously, and after much pushing it was gotten into satisfactory condition.—April 1903.

1902.—Inspected April 15th; A. G. S.—Ventilation was good. Drainage was bad. The roof of the Main towards the head was unsafe.

1902.—Inspected December 12th; A. G. S.—The mine was idle, hence measurements of air could not be made. It seemed clear, however, that the furnace was inadequate for the mine, with the excavation that had been made. A door was needed on the Main, beyond the 1st Right, and one beyond the 2d Right. Room curtains on the 1st Right were bad.

JOHNSON MINE.

Mine and Head Office, Fordsville.

Transportation by Owensboro Division of I. C. Railroad and by L., H. & St. L. Railroad.

Operated by the Fordsville Block Coal Co., W. S. Gaines, President and Manager; C. E. Ford, Vice-president; Ike C. Adair, Secretary and Treasurer.

Inspected three times in 1901, by C. W. Logan. Three inspections were made in 1902.

1901.—Last inspection was made November 25th. The notice is: "Ventilation not bad. However, the room on right of Main entry, as formerly talked with Mr. Gaines, must be driven on for the new furnace location, as the present fire arrangement is not very effective. Drainage reasonably good, excepting 1st Left entry. Some roof on Main entry near head needed pulling, where indicated Mr. Gaines."

1902.—Inspected May 28th; A. G. S.—There was practically no ventilation entering the mine, and no provision had been made for properly coursing the air, even had there been a current. The mine generally was in quite a bad condition.

1902.—Inspected September 21st; A. G. S.—A sufficient current was entering the bank, but it did not reach the diggers.

1902.—Inspected October 17th; A. G. S.—The condition of the mine had been very much improved. Ventilation was good, and the bank generally was in a much better condition.

McHENRY MINE.

Mine Office, McHenry.

Transportation, Illinois Central R. R.

Operated by the McHenry Coal Co., T. C. duPont, President; W. D. McElhinny, Vice-president and Treasurer; Spalding Coleman, Secretary; E. A. Foster, Superintendent.

The mine, entered by slope, is ventilated by a 6-foot, double Murphy fan, installed in 1890, which is driven by an 8 by 7 Ames engine. Drainage is by a No. 7 Dean Bros. 12 by 8 steam pump, located at the air shaft. Tailrope haulage is used on the Main entry, and comprises one pair of 12 by 24 Nelsonville Foundry and Machine Co.'s haulage engines complete, with drums operating 13,000 feet of $\frac{3}{4}$ -inch steel haulage rope, and one pair of 10 by 20 Atlas hoisting engines of 70- H. P. About 80 per cent. of the output is cut by electric machine, the equipment, which was installed in 1896, consisting of one 150-H. P. 15 by 16 McEwen engine, driving an "Independent" 135-H. P. dynamo, giving 250 volts at 600 r. p. m., and six Jeffrey chain machines, four of 5-foot cut and two of 6-foot cut. The boiler battery consists of three Walton boilers—two 40 by 20, having two 14-inch and two 3-inch flues, and one 72 by 16, having two 16-inch flues; one 36 by 18 Kettle boiler; one No. 3 Dean Bros. boiler feed pump, and one Reilly 7 by 4 by 10 boiler feed pump, and one Walton feed water heater complete. The plant also includes: One Parker shaker screen and weigh pan, having 800 tons daily capacity, which is operated by a Grainger 9 by 12 engine; one 66-foot Fairbanks standard track scales; one 5-ton Fairbanks standard platform scales, and one 5-ton Howe standard platform scales.

On July 2, 1902, the tipple burned down, and the mine was idle until about October 15th.

The mine was inspected in March and November by Mr. C. W. Logan, and in August, by Mr. G. W. Stone, 1901. Two inspections and one visit were made in 1902.

1901.—Last inspection was made November 22d. The notice

is: "Ventilation good as expected, all things considered, though when certain connections are made, as discussed with mine boss, no doubt ventilation will be improved. However, excepting faces of Main, 14th North and 14th South entries, no defective ventilation was discovered. Some needed and excellent timbering has been done on Main entry. Drainage satisfactory. Roof reasonably well supported."

1902.—Inspected June 10th; A. G. S.—Plenty of air was entering the bank, but it was not conducted so as to properly ventilate all the working places. There was practically no current passing the working faces on the 14th North, and there was not enough traveling the working places on the 11th and 12th South. Room faces were in a number of instances carried too far beyond the air. The roof of the 12th North was in bad condition from mouth to face, and the top of the 11th South was unsafe between the mouth of the entry and the first curtain.

1902.—Visited August 26th; A. G. S.—Work had not been resumed.

1902.—Inspected December 16th; A. G. S.—The condition of the mine had been very much improved, but ventilation was still defective in some parts of the workings.

RENDER MINE.

Mine Office, Render.

Head Office, Louisville.

Transportation, Illinois Central Railroad.

Operated by the Central Coal & Iron Co., T. C. duPont, President; W. D. McElhinny, Vice-president and Treasurer; Spalding Coleman, Secretary; E. A. Foster, Superintendent. Mine foreman, Simon Jones.

The mine (a drift) has a 5-foot by 6-foot furnace, with 5-foot grate bars for ventilation, but it is of little value in the present condition of the workings. Effort was made to improve ventilation by putting in a small electrically-driven fan, but it proved of little service. (See notes beyond.) In consequence of pressure

brought to bear by this office, a new air shaft was located and a good fan ordered. The shaft is to be completed by the middle of February, 1903, and the fan installed without delay upon its receipt. All coal is cut by electric machines, and Main entry haulage is by electric locomotive. The electric equipment was installed in 1895. The plant includes the following: One 150-H. P. McEwen 15 by 16 engine, driving an "Independent" 135-H. P. dynamo, giving 250 volts at 600 r. p. m.; three Morgan-Gardner, and three Link-Belt chain breast machines of old type; one 10-ton Jeffrey and one 7-ton Link-Belt haulage motor; one Dean Bros. electric pump, rated at 10-H. P.; one 2-H. P. Eddy motor, which was used to operate the small fan mentioned above. The boiler battery consists of three Walton boilers, two of which are 42 inches in diameter by 26 feet long, with 14-inch flues; and one 72 inches in diameter by 16 feet long, having seventy-eight $3\frac{1}{2}$ -inch tubes. The boilers are supplied by a No. 4 Reilly 4 by 6 steam feed pump. The plant also includes a Parker shaker screen with weigh pan, of 800 tons daily capacity, which is operated by a 6 by 14 engine; a single 12 by 20 Frost hoisting engine, for the tipple, the latter being a shaft-hoist; two 60-foot Fairbanks standard track scales, and one 5-ton Fairbanks standard platform scales.

The mine was inspected in March (C. W. Logan), May (Logan), June (G. W. Stone), August (Stone), and November (Logan), 1901. Three inspections were made in 1902.

1901.—Inspected by G. W. Stone August 22d. The notice is: "The mine ventilation was fair, but not as good as it ought to have been, but much better than heretofore found. I note the intention to sink a new air shaft, when the work shall advance to the desired place. Other conditions good."

1901.—Last inspection (C. W. Logan) was made November 23d. The notice is: "Mine was idle, and no one was in excepting a few day men making repairs, hence a very thorough air-determination was not obtainable; however, the fan was running and a good fire was in the furnace, and it was quite evident that an air betterment had resulted since my former inspection. The atten-

tion of managers Jones and Gwyn was directed to some timbering needed on 2d South entry. Drainage good."

1902.—Inspected June 17th; A. G. S.—There were 131 persons underground and yet only 4,433 cubic feet of air entering the bank. What air was entering did not reach the faces of working places. In brief, all things considered, the mine was practically without ventilation.

Following service of the notice concerning the defective condition of the mine as found on June 17th, the Chief Inspector wrote to the company, under date of June 21st, as follows:

"Gentlemen: Referring to the inspection notice served on you by the Assistant Inspector of Mines, with reference to the Render mine, I have examined into the history of the mine during 1901, as shown by inspection notices on file in the office. I find that five visits were made to the mine during the year, and that there was a continuous complaint of insufficient ventilation, the conditions being so very defective in May that work in the mine was suspended. Thus:

"Notice 31. Logan. March 15th.—The ventilation was insufficient, but a new air-shaft, etc., was promised, etc.

"Notice 103. Logan. May 6th.—Ventilation still not good. A suspension agreed upon until mine should be placed in condition required by law.

"Notice 34. Stone. June 17th.—Ventilation 'fair,' but not satisfactory—needed improvement. Improvement promised.

"Notice 44. Stone. August 22d.—Ventilation not what it should be. New air-shaft still promised.

"Notice 309. Logan. November 23d.—Mine idle and thorough inspection could not be made, but a betterment since last inspection apparent.

"And now, on June 10th of this year, the mine is found to be in as bad a condition as ever, if not a worse one. Gentlemen, this will not do. I beg to assure you, courteously but firmly, that the law must be complied with in every respect, and unless this is

done promptly, I shall place the matter in the hands of the Commonwealth's Attorney, and urge vigorous action."

The matter was taken up by Mr. McElhinny, who had recently taken charge of affairs at the Central City office, and the writer is satisfied that he sought in good faith to have the mine put in good condition promptly as possible. But there were failures and delays one after the other, and it was not until in February of the present year that the mine was brought into good condition. A new air shaft had to be sunk, the Main entry had to be extended to the point where the shaft would come down, and a fan had to be purchased and installed. Extension of the entry was slow, since there were difficulties in the way of double-shifting it—though the writer believes it could have been pushed faster—and it did not reach the necessary point until about the middle of December. The fan was ordered in December, but it also was delayed. When the writer visited the mine January 1st, arrangements for starting the shaft were just being made—whereas the shaft should have gone down while the entry was being driven.

Under the circumstances it is deemed unnecessary to quote from inspections made August 26th and November 27th, since they repeat the same tale of insufficient ventilation. It should be stated, however, that efforts were made to better conditions subsequent to the June inspection by making some changes with respect to the running of an electric pump and a small fan, which were hitched to the same motor. The current was not sufficient to run pump and fan together and give any speed to the fan. Efforts to make a better arrangement failed.*

TAYLOR MINE.

Mine Office, Taylor Mines.

Head Office, Louisville.

Transportation, Illinois Central R. R.

Operated by the Taylor Coal Company of Kentucky, J. B. Speed,

*April, 1903. An inspection made this month shows the mine to be in a satisfactory condition.

President; W. A. Jones, Secretary and Treasurer; I. P. Barnard, Superintendent. Mine foreman, N. Barrass.

The mine is ventilated by furnace. The total output is machine mined. The mine is equipped both with air and with electricity, the latter being used principally for haulage while the coal is cut principally with air-driven machines. The plant includes: Nine Ingersoll-Sergeant and six Sullivan pick machines, and one Morgan-Gardner electric chain breast machine; two Jeffrey motors, of 10 tons and 7 tons, respectively, and one 10-ton Westinghouse motor.

The mine was inspected in March (C. W. Logan) and in August (G. W. Stone), 1901. Two inspections and one visit were made in 1902.

1901.—The last inspection was made August 23d. The notice is: "The mine, as usual, was found to be in most excellent condition in all respects."

1902.—Inspected June 9th; A. G. S.—"All conditions satisfactory."

1902.—Inspected August 25th, A. G. S.—An ample volume of air was entering but it was not satisfactorily conducted. In the working places on the 4th Cross and on the 5th Cross off of 3d Right, the current was too weak to afford a measurement. Break-throughs were needed between some of the rooms on the 4th Cross; also some check-curtains to turn the air into rooms.

1902.—Visited December 15th; A. G. S.—The mine was flooded and could not be examined.

WILLIAMS MINE.

Mine Office, McHenry.

Head Office, Louisville.

Transportation, Illinois Central R. R.

Operated by the Williams Coal Co., I. P. Barnard, President; W. A. Jones, Secretary and Treasurer.

The output of this mine for 1902 was hand mined, but at the close of the year the mine was being equipped for electric haulage and with air-driven pick machines. The new installation includes

16 Ingersoll-Sergeant punchers; an Ingersoll 22 by 24 compressor; a Ball engine of 140 horse-power; a General Electric 100-K. W. (130-h. p.) generator, and a 10-ton, 30-h. p., Jeffrey electric locomotive.

The mine was inspected in March (Logan), August (Stone), and in November (Logan), 1901.

1901.—Last inspection was made November 23d. The notice is: "All essential conditions good."

1902.—Inspected June 11th; A. G. S.—For 113 persons inside the intake of air amounted to only 4,303 cubic feet, and this had dwindled to 3,927 feet by the time the 3d West was reached. Arrangements for sending the air to the working places were good, had there been sufficient current to send.

1902.—Inspected August 26th. Very little improvement in the ventilation was noted. An air-shaft was needed on the 1st West air-course, and it was evident that a fan there (exhausting) would serve better than a furnace. On the 1st West, where 8,700 to 9,000 feet of air should have been traveling, a volume of only 2,988 feet was found.

1902.—Inspected December 18th; A. G. S.—Ventilation, drainage, and timbering were satisfactory.

Union County.

The output in tons for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
American C. & I.	6,618.50	1,754.94	9,661.67	18,035.11
Paducah	14,652.04	.....	65,985.32	80,637.36
Davidson's	5,150.00	544.00	1,159.00	6,853.00
DeKoven No. 9	3,877.00	389.00	90,138.00	94,404.00
Tradewater .....	.....	.....	102,274.00	102,274.00
Total	30,297.54	2,687.94	269,217.99	302,203.47

AMERICAN MINE.

Mine and Head Office, Uniontown.

Transportation, Ohio Valley R. R.

Operated by the American Coal and Iron Co., A. W. Voetgly, President; R. A. Brashear, Secretary and Treasurer; D. E. Caulton, Superintendent. Mine foreman, Thomas Coxon.

The mine (a shaft) has only one outlet, hence the company was required to either sink another shaft or reduce the number of persons underground to the legal limit—ten. It chose the latter alternative.

The mine was inspected in May (C. W. Logan), and in October (G. W. Stone), 1901. Three inspections were made in 1902.

1901.—Last inspection was made October. The notice (October 24th) is: "Your mine was found to be in a most excellent condition in all respects."

1902.—Inspected May 24th; A. G. S.—Ventilation and drainage were satisfactory. Undue confidence in the strong roof led to lack of timbering in rooms.

1902.—Inspected September 9th; A. G. S.—Ventilation was unsatisfactory, in that the current was not conducted so as to reach all the working faces. Waste was allowed to accumulate in breakthroughs in use. The hoisting cages needed covers.

1902.—Inspected October 29th; A. G. S.—In consequence of a leaking current the 1st North was without ventilation. There was also practically no ventilation on the 3d North.

CUMBERLAND MINE.

Mine Office, Sturgis.

Transportation, Ohio Valley Railroad and the Ohio River.

Operated by the Paducah Coal & Mining Co., T. J. Flournoy, President and Treasurer (Paducah); D. A. Brooks, Superintendent.* Mine foreman, Virgil Bird.

*The mine is now operated by the United States Coal, Gas and Coke Co., successor to the Paducah Coal and Mining Co.

The mine, a slope, is ventilated by a 10-foot fan, acting as down-cast. Haulage on the slope is by tailrope.

The mine was inspected in May (C. W. Logan) and in October (G. W. Stone), 1901. Three inspections were made in 1902.

1901. -Last inspection was made October 25th. The notice is: "The mine was found to be in most excellent condition."

1902.—Inspected May 22d; A. G. S.—For 93 persons in bank, an intake of only 4,236 cubic feet of air was provided. Moreover, provisions were not made to thoroughly distribute the air through the working places even had there been a sufficient current. Doors and brattices were in bad condition. Warning as to the liability of fire-damp to appear in the mine was given. The timbering near the mouth of the slope needed renewal.

Inspected September 6th; A. G. S.—Plenty of air was entering the bank, but ventilation was still defective, because the current did not properly travel all the working places. Brattices and stoppings were leaky, causing losses of air before it could reach the diggers.

Inspected October 27th; A. G. S. The ventilation had been much improved, but it was still defective in some of the working places.

DEKOVEN No. 9 MINE.

Mine and Head Office, DeKoven.

Transportation, Ohio Valley R. R. and the Ohio River.

Operated by the Ohio Valley Coal and Mining Co., Saml. S. Brown, President (Pittsburgh, Pa.); Saml. P. Sturgis, Secretary; John Whitehead, Superintendent. Mine foreman, W. R. Carter.

About 70 per cent. of the output is machine mined. The plant includes eight Sullivan pick machines; an Ingersoll air compressor; one pair of 10 by 12 hoisting engines and one 10 by 40 hoisting engine. Boiler batteries are as follows: No. 1, 36 inches diameter by 22 feet; No. 2, 54 inches diameter by 15 feet; No. 3, 36 inches diameter by 24 feet.

The mine was inspected in May (C. W. Logan), and in October (G. W. Stone), 1901.

1901.—Last inspection was made October 25th. The notice is: "The mine was found to be in most excellent condition."

1902.—Inspected May 23d; A. G. S.—Plenty of air was entering, but it was not well conducted. Break-throughs were left open along air-courses, hence, the current did not reach the men; and brattices and doors were in bad condition. More attention to drainage was necessary.

1902.—Inspected September 8th; A. G. S.—There was very little, if any improvement in the condition of the mine.

1902.—Inspected October 28th; A. G. S.—Ventilation had been very much improved, but there were still some working places where sufficient air was not going.

TRADEWATER MINE.

Mine Office, Sturgis.

Transportation, Ohio Valley R. R.

Operated by the Tradewater Coal Co., Jacob L. Frankel, President; W. F. McMurry, Superintendent.

Two fans are used for ventilating mine, one of them acting as down-cast and the other as up-cast. The down-cast is a 12-foot Cole fan, installed in 1893, placed at the shaft; the other, which is placed at the slope end of the workings, is a 10-foot Brazil fan, installed in 1901.

About 90 per cent. of the coal is machine-mined, two Sullivan and fourteen Ingersoll-Sergeant punchers being used. Rope haulage is used, one line of 1,400 feet on the Main entry, and another line of 600 feet which feeds the main line. Since the workings follow the rise of the coal, the rope operates by gravity.

The mine was inspected in May (C. W. Logan) and in October (G. W. Stone), in 1901.

1901.—Last inspection was made October 25th. The notice is: "The mine was found to be in most excellent condition. I

note the construction of the new fan out on the slope, and your intention to provide better power for the fan at the shaft and thus make it more effectual.

1902.—Partially inspected May 22d; A. G. S.—That part of the mine examined appeared to be in satisfactory condition.

1902.—Inspected June 27th and 28th. A thorough examination of the mine was made. Ventilation was found to be very defective. Sufficient air was not sent to the working portions of the bank, and the current was not sent into the rooms and kept traveling within the legal distance of the faces. Brattices along the main air course for the East Side split were rotten and of comparatively little value. In many instances break-throughs were made too small, acting as “reducers” on the current. In a number of rooms timbering was inadequate. A detailed and comprehensive notice was served on the company, from which the following is an extract:

“SUMMARY AND REMARKS.

“1. On the East Side the air is not well enough confined to a single, clear air-course from the shaft to the 3d East entry. This must be remedied. The air-current must be given a clear track—sufficient as to space (equal in area to at least that of the regular entries), and free from rubbish. All defective brattices must be repaired, decayed ones renewed, and the air prevented from wandering ‘at will’ through old rooms, and from escaping into spaces where not needed. Where needed in order to confine the current to a regular course, brattices or other suitable stoppings must be put in. When necessary to carry the air across old rooms, it must be conducted so as to pass regularly across, and in case of such rooms ending in the solid, it must be carried near the faces.

“2. The 3d East Entry. The current must be so conducted to this entry that its full volume will reach the east end of the entry; a curtain or door must be hung on the entry between the

last two rooms that are up far enough to have break-throughs (the rear break-throughs of the next to last of said rooms being kept closed), and the current kept traveling through the rooms toward the drum, within 60 feet or less of the faces—additional curtains being hung at proper places if necessary for such purpose. The current must be kept traveling within 60 feet or less of the faces of the rooms west of the drum also. Either a break-through must be made from room 22 (the drum room) to the next one west, and the air thus sent on its proper course; or a curtain must be hung on the entry between the 1st and 2d rooms west of the drum (rooms 21 and 20)—provision being made to keep the air from wasting on the north side of the entry if necessary—and the rear break-throughs between said rooms closed so as to cause the air to go into said rooms and flow through the last break-throughs, which must be kept up in accordance with legal provisions.

“3. In all working rooms the air must be made to pass regularly through break-throughs between the rooms, and the current must be kept within 60 feet or less of the faces.

“4. The 6th West Entry. A curtain must be hung on the entry between the last two rooms that are up 60 feet or more, the rear break-throughs of next to last of said rooms kept closed and the air made to travel regularly within 60 feet or less of the room faces. The full volume of air must be made to travel through the last break-through between the entry and the air-course.

“5. The 5th West Entry. A curtain must be hung on this entry in same way as prescribed for the 6th West, and the current kept traveling as already described.

“6. The 4th West Entry. A curtain must be hung on this entry as prescribed for 6th and 5th West entries, and the current kept traveling as already described.

“7. West Wing. A clear course, of adequate size, must be maintained, to bring the total volume of air from the East Wing to this entry (through the last break-through between entry and its air-course). I noted a curtain between rooms 22 and 23, but

another one must be hung across the entry between the last rooms, as prescribed for the other West entries, and the current kept traveling as already described. On account of the fire-damp on this entry and in rooms, an *abundant* supply of air should be brought to the workings here, so as to dilute and render harmless all emissions of said gas, not only in rooms, but on entry.

"8. East Wing Entry. All rooms up 60 feet or more must have break-throughs within 60 feet or less of faces, and the current made to travel through the last break-throughs. This is not difficult to do.

"9. The idle rooms on the Original 1st East entry should be constantly watched, to see that danger does not arise from accumulations of fire-damp and outbursts of the gas, thus loading the ventilating current with the gas to such extent as to render it explosive. Said places should be fenced off with warning boards (as should be all places in the bank where accumulations of fire-damp occur), and no one should be allowed to enter them with a naked light.

"10. A record of the daily inspections for fire-damp required by law should be kept in the company office, and a copy of each daily inspection should be posted where it can be seen by the men before they enter the mine. This is an important matter; the men should know what the conditions are as to fire-damp each morning before they go in.

"11. At least one of the fans should be kept running both day and night, and when men are working in various parts of the mine at night both fans, if practicable, should be kept running as long as they are in. In case of a shut-down, men should not, upon resumption of work, be sent into the mines until the fans have been running at least twelve hours.

"12. I do not like your present plan as to direction the ventilating current is to take. As the air now flows—i. e., from the fan at shaft to the one on slope—the current goes to the gassy parts of the mine first, and then to the men. I strongly recommend that, during the warm and mild seasons at least, and until

freezing weather comes, the current be reversed. That is to say, make the slope fan the down-cast, and the shaft fan the up-cast. Such a change at the fans should be a very easy matter. (I presume the fans are built so that they can be so arranged), and other arrangements in the mine for coursing the air throughout the bank in accordance with legal requirements can readily be made to accord with such reversal of current. Of course, if the direction of the current is reversed, in accordance with this suggestion (which I strongly favor), the placing of curtains, etc., as required in this notice, must be modified to suit the change of direction. I deem it quite probable that if the direction of the current is changed not only will the fire-damp be carried away from the men instead of toward them, but the volume of air will be obtained more easily and the bank be ventilated more easily.

"13. I understand that the loaders do the shooting (blasting) in this mine. I will remark that it would be better for the safety of the men if the shooting was done by the company, and no shots fired in the mine until all persons except those specially employed to do the shooting have left the mine.

"14. The hoisting ropes at the shaft should be carefully examined each day, and the safety-catches on cages should be tested at least once a week.

"15. I noted that you are making your rooms 30 feet wide (some of them measured more); that props in them are set in rows 6 to 10 feet apart, and that as a rule a row consists of only two props between tracks and one prop, sometimes two props, between rib and track on each side of room; and that, as well as I could make out, room pillars are laid off to be about 10 feet thick. I do not believe you are setting enough props in the rooms; and in my opinion pillars between 30-foot rooms in your mine should be not less than 15 feet thick. Good, heavy caps should cover each prop.

"16. I also noticed that you let rooms coming from one entry to break into the next entry at full width. This is a very bad practice. When up to within 10 or 12 feet of the next entry (an

air-course in your case), the room should be narrowed, as it breaks through, so as to leave a good stump on the entry. And it is well not to break through from every room.

"I recognize the fact that the requirements enumerated herein as necessary to put your mine in a safe and healthful condition means the expenditure of work and money, but I respectfully suggest that it will be less expensive to promptly and fully comply with this notice than to fail to do so, or to do so in a limited way. For the mine must be put in proper condition, otherwise it will be my duty (which I shall not fail to perform) to put the matter in the hands of the Commonwealth's Attorney and urge vigorous action. But I trust that you will make no delay, and that you will receive (as you should) the frank and hearty cooperation of the bank committee—wherever such assistance may be desired—not only in the work of straightening up the mine, but in the subsequent maintenance of good conditions."

Inspected September 5th; A. G. S.—The ventilation had been brought into satisfactory condition on the East Side. On the West there was little, if any, improvement. Work toward improving it was in progress.

Inspected October 25th; A. G. S.—The mine had been very greatly improved. Conditions were satisfactory on both sides, with the exception of the entry, on West Side, known as the "Pump entry" (West Wing). Too small a split of air was sent to the face of that entry, since fire-damp existed in rooms on it.

UNIONTOWN (DAVIDSON) MINE.

Mine and Head Office, Uniontown.

Transportation, Ohio Valley R. R.

Operated by B. C. Davidson & Sons, B. C. Davidson, President; H. T. Davidson, Secretary and Treasurer. Mine foreman, Wm. Hammons.

The mine was inspected in May (C. W. Logan) and in October (G. W. Stone), 1901. Three inspections were made in 1902.

1901.—Last inspection was made October 24th. The notice is: "Conditions not good. Plans to better them were discussed with the company."

1902.—Inspected May 24th; A. G. S.—There was practically no current entering the mine, and even had there been one, the air would not have gone to the men. All entries were ahead of the air, and air-ways were filled with gob. Notice that no more than 10 persons should be employed inside, so long as there was but one outlet, was given.

1902.—Inspected September 9th; A. G. S.—All conditions were satisfactory.

1902.—Inspected October 29th; A. G. S.—All conditions were satisfactory.

Webster County.

The output in tons for 1902, according to classes, was as follows:

MINE	Lump	Nut	Miscellaneous	Total
Sebree	11,519.75	2,834.25	64,582.00	78,936.00
Shamrock	388.60	320.00	180.00	898.60
Providence	2,856.00	905.00	91,153.00	94,914.00
Wheatcroft	2,517.00	891.00	38,246.00	41,654.00
Total	17,281.35	4,960.25	194,161.00	216,402.60

PROVIDENCE MINES.

Mine and Head Office, Providence.

Transportation, L. & N. Railroad.

Operated by the Providence Coal Co., W. A. Nisbet, President; W. J. Nisbet, Secretary and General Manager; Percy D. Berry, Assistant Secretary; F. D. Ramsey, Treasurer; W. J. Garrett, Superintendent. Mine foremen: W. R. Doyle, at the slope; C. R. McNeil, at the shaft.

The company has two mines, one (the oldest) entered by slope, and the other entered by shaft. Each mine is ventilated by a 10-foot fan, made at the company's shop. The fan at the slope was installed in 1893, and the one at the shaft was put in in 1902.

Nearly 75 per cent. of the coal is mined by electric machines, two Jeffrey and one Morgan-Gardner chain breast machines being used at the slope, and two Jeffrey chain machines at the shaft. The slope is equipped for electric haulage. The plant includes one 133-H. P. McEwen engine, driving a Westinghouse 100-K. W. generator; and a 10-ton Baldwin electric locomotive.

The slope mine was inspected in May and in October, 1901, by C. W. Logan.

1901.—The last inspection was made October 10th. The notice is: "Excepting a few brattices needed where indicated mine boss, ventilation satisfactory. Drainage, pumping and timbering good."

1902.—Slope Mine. Inspected June 13th; A. G. S.—All conditions were satisfactory.

Inspected again September 2d, and found in satisfactory condition.

1902.—Shaft Mine. Inspected June 13th; A. G. S.—There was practically no current entering for the 25 persons inside. There were neither covers nor safety-catches to the hoisting cages.

Inspected again September 2d; A. G. S.—Ventilation had not been improved, but arrangements for doing so had been made. A fan had been ordered and was expected daily. Material was on the ground with which to repair the shaft.

SEBREE MINE.

Mine and Head Office, Sebree.

Transportation, L. & N. Railroad.

Operated by the Sebree Coal Co., S. F. Powell, President; J. B. Ramsey, Vice-president; C. F. Hall, Secretary and Treasurer; J. A. Powell, L. O. Biggs, Directors. Mine foreman, Joseph McIntyre.

The mine is ventilated by a 6-foot Stein fan, installed in August, 1901.

The mine was inspected by C. W. Logan in May and October, 1901. A visit was made by G. W. Stone in December. (See memorandum under Empire mine, Christian county.)

1901.—Last inspection was made October 11th. The notice is: "Owing to Main entry air-way on West Side being badly clogged by slate falls, the air-volume of 20,000 cubic feet per minute passing into the mine for the 70 persons working therein is inadequately distributed and fails to reach head North and South entries. Instructions were given mine boss to clear out this air-way at once. With this done, no doubt ventilation will be good."

1902.—Inspected June 14th; A. G. S.—All conditions reported as satisfactory.

1902.—Inspected September 1st; A. G. S.—Plenty of air was sent to each side of the bank, but in consequence of poor curtains the working places were without sufficient ventilation.

SHAMROCK MINE.

Mine Office, Providence.

Transportation, L. & N. Railroad.

Operated by the Shamrock Coal Co., Mr. Price, President; Mr. Wooten, Secretary; Virgil Givens, Treasurer; John Orr, Superintendent.

This mine, a shaft, was opened in 1902, the first shipments being made in November.

The mine is ventilated by a 12-foot Brazil fan, recently installed.

No inspection of the mine was made.

WHEATCROFT MINES.

Mine and Head Office, Wheatcroft.

Transportation, by W. K. R. R. to the Ohio Valley Railroad.

Operated by the Wheatcroft Coal & Mining Co., Irving H. Wheatcroft, President; W. O. Horr, Auditor.

The company operates two mines, a shaft and a slope, in No. 11 coal. The shaft was sunk in 1901. It is proposed to sink another shaft, 135 feet deep, to No. 9 coal. At both slope and shaft ventilation was dependent upon inadequate furnaces. A fan will be installed at the shaft mine.* The company has under construction a battery of 25 beehive coke ovens, and it reports that very satisfactory oven tests have been made with the coal. Under date of January 14, 1903, the President writes: "The result of our last test was that the coal produced 62 per cent. of coke of a very high grade, of a structure that is unsurpassed by any, and only 1.5 per cent. sulphur. This was made from a straight carload of our coal that was not washed. Dr. R. S. Moss, of Chicago, late of the Universal Coal Co., has been engaged to superintend our coking department, and he is quite satisfied that he will be able to produce a first-class metallurgical coke from our coal." In view of the experience elsewhere in coking No. 11 coal, the results as obtained in continuous practice at Wheatcroft will be watched with much interest. Should the expectations of Dr. Moss prove well-founded, there should be a ready market for the coke at the furnaces of the Cumberland river district.

1901.—The slope was inspected May 18th by Mr. Logan. Fol-

*Since this report was in course of preparation, a Cole fan, with rated capacity of 30,000 cubic feet, has been installed at the shaft. An additional boiler, 80 horse power, Houston, Stanwood & Gamble Co. (Cincinnati), has also been put in at the shaft, and a new shaker screen (Southern Manufacturing Co., Princeton, Ky.), arranged for. Three coke ovens are completed and in operation.

lowing is the report: "Ventilation inadequate, occasioned by the insufficiency of the present fire arrangement to produce sufficient air-draught, and imperative instructions were given W. D. Newcomb to immediately build a furnace according to verbal instructions and specifications submitted. Considering the character of this mine, operations and excavations, conditions in other respects about as good as expected."

1901.—On October 25th the mine was visited by Mr. Stone, who reports: "The mine was idle and furnace cold, and no one around, and no inspection was made."

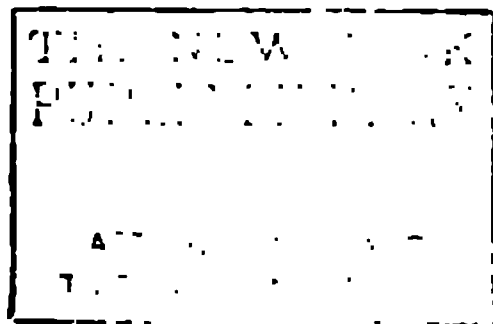
1902.—Slope. Inspected May 23d.—The mine had practically no ventilation. Practically no air was entering the bank, and no provision was made for conducting what did enter to the working faces. The furnace seemed inadequate, and it was understood that no fire was made in it until after the men had entered for work.

1902.—Slope. Again inspected September 6th. No improvement was noted. The matter was taken up with the company in a vigorous manner and the condition of the mine was improved.

1902.—Shaft mine. Inspected May 23d. With only 19 persons inside, ventilation was sufficient, but the drainage and timbering were not satisfactory. The mine was too wet, and foreprops were not kept close enough to faces of the rooms.

1902.—Shaft mine. Inspected September 6th.—Practically no air was entering the mine. Attention was called to the fact that the furnace relied upon was inadequate, and demand made that either an adequate furnace or a fan be provided.*

*A fan has been installed during the preparation of this report.





Blue Gem Mine: Incline and Tippie.

XI.**Working the Blue Gem Seam on the Longwall Plan
at Kensee.**

BY HYWEL DAVIES.

The Jellico District has become famous because it has furnished the South with the very highest standard of bituminous domestic coals. It has not only more than held its own in competition with all other Southern coals, but on tests it has demonstrated its ability to easily compete with Northern and Eastern bituminous coals in its special domestic qualities,—which are that it is free-burning, is very low in red ash, does not bind or coke, and that it is practically free from sulphur. It is not a smokeless coal, but with a proper grate with back-plate at an angle of 45 degrees it becomes so. Such is the intensity of the heat generated by the coal and reflected by this deflecting back wall that the smoke is consumed much on the same principle as that in the action of a lamp globe.

No other Southern coal finds market in so many States, and, if railroad facilities were more plentiful, it would easily lead all bituminous domestic coals of the United States in its reach for markets. A small tonnage, only, goes north of the Ohio, on account of lack of transportation, but nearly every Southern State is a ready buyer.

The tonnage of the district is only 750,000 tons per annum, and while it commands the best market prices prevailing, its cost of production is correspondingly higher, because nature seems to abhor volume in quality. The precious things are always scarce, and so it is with this ideal domestic coal.

The district is only twelve miles long, reaching from Pleasant

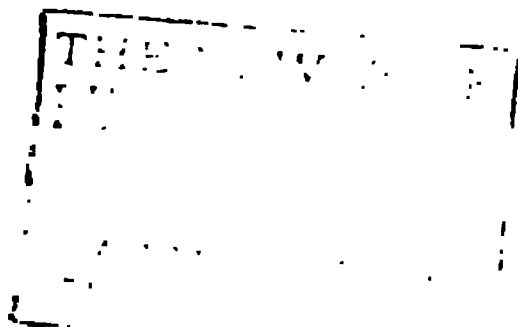
View, on the northeast, to Newcomb, on the southwest, with Pine Mountain on the south and Jellico creek on the north. Thus limited, in area as well as in quantity or thickness, yielding barely 3,500 tons per acre on an average, and exhausting over 225 acres annually, the days of "Jellico" supply are necessarily numbered, now that it is about to celebrate its 20th anniversary of its first shipment.

Alabama and Tennessee have made strenuous efforts to find a domestic substitute for "Jellico," but without success. It is Kentucky alone that seems to be able to furnish the best substitutes—not only in quality, but in quantity as well, as evidenced by the splendid coals now mined on the Cumberland Valley branch of the Louisville & Nashville railroad, and on sections of the Cincinnati Southern Railway in Kentucky; although it is not yet apparent that any of the new aspirants will completely come up to the domestic ideal of "Jellico," which has not only been guarded in a pre-eminent manner for twenty years, but will within a few years transfer its mantle of superiority to a new, but smaller, development, known as the "Blue Gem Vein," which lies about 90 feet below the "Jellico Vein" and about 150 feet above local drainage, or about 1,100 feet above sea level. (See Figure 2.)

This new aspirant for domestic supremacy is higher in carbon and lower in ash and sulphur than "Jellico," but, on account of its higher per cent. in carbon, makes a more economical fire, also generates 10 per cent. more units of heat than "Jellico," and makes a very fine coke.

But Nature, true to her principle of not associating volume with quality, reduced the 39 inches of "Jellico" to 24 inches "Blue Gem," with a corresponding increase in cost of production. The coal is sufficiently well known in the South, so that buyers now discriminate in its favor against "Jellico," as for years hitherto they have discriminated in favor of "Jellico" against other coals. It will never seriously affect "Jellico," as the supply mined is too limited, and its mining cost of production

Mr^a



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"Jellico" a fair margin of profit when sold at the B. G. cost price, thus eliminating any immediate prospect of serious competition.

"Blue Gem" can only be viewed in the light of a domestic substitute for "Jellico," whose output has practically reached its high-water mark, and as "Jellico" decreases "Blue Gem" must increase, if no other coal is found to satisfy the discriminating tastes of Southern homes in the matter of fuel.

Some "Blue Gem" coal has been mined during the last twelve years, but hardly a single operation has exceeded 15,000 tons per annum, and it is safe to say that the ten mines now operating in this vein do not have an aggregate capacity of 75,000 tons per annum, or one tenth of the output of "Jellico" coal.

One reason why development has been so slow, is because the same mining methods have been followed in the "Blue Gem" as in the "Jellico," namely, the pillar-and-stall, which limits operations in such thin coal.

The writer has watched the growing reputation of "Blue Gem" with some interest, but could see no encouragement to develop that vein, unless some other method than the one in vogue could be put into practice. It has been very evident that much of its success depended on working the "Blue Gem" concurrently with the "Jellico," because the larger tonnage of the latter would materially aid the smaller tonnage of "Blue Gem" to carry the burden of fixed charges, etc. Taking this view, we decided to proceed with its development last summer, and after considering every known method of working thin coals, we decided to do so on the Longwall plan. Selecting a point 1,200 feet west of the Jellico Tipple, we made two openings into an oblong tract of 900 acres of this vein. These openings are 8 feet by 6 feet high and 60 feet apart and 260 feet through the solid or outcrop pillar. At that point the Longwall plan begins. (See diagram.) The Main entry, or continuation of A, is the main haulage road, and is the intake from A to B. Entries No. 1 Right and No. 1 Left are driven at right angles to A. These are practically "gob" entries, as the coal is all taken out for 10 feet on each side as the entries advance, and the roof slate, brushed in order to get the necessary

mule height of $5\frac{1}{2}$ feet, is carefully packed and walled in the space occupied by the coal. "A" is driven in the solid and has 6,500 feet to reach the outcrop on the other side of the mountain. The slate from this entry is taken to the outside or used for packing as found necessary.

A reference to the diagram shows how the workings take a fan-like shape with every pound of coal removed, leaving no coal pillars to protect roadways, etc., while only one-third the timber needed in "Jellico" is used.

The method of operation is, in brief, as follows: Beginning 30 feet from junction of entries "A" and "B," we start on the face, taking out the coal twelve feet on each side of a 6-foot roadway, which is brushed 39 inches above the rail, gobbing and walling the slate in the place of the coal, except that the entry corners are cribbed with 4-foot timbers laid crib-fashion and packed with slate. This is repeated every thirty feet on each side of the Main entry as it advances. Proceeding thus, we had, the first of this year, a working face of nearly 500 feet on each side of the entry. When these roadways or rooms are driven 150 feet, they are cut off by a parallel butt entry, the track taken up and the room roadway filled with slate. This process will be repeated every 150 feet on the face. The Main entry, as well as other parallel entries, are driven on the butts, and "Level" entries and rooms are driven on the face. All butt entries will be cut off again by Level entries, 1,000 feet apart as the Main entry advances.

The workings will be kept in spade or fan shape, as shown in the diagram. This equalizes the pressure on the face of the workings, which is of prime importance, since the principal secret in the successful working of Longwall is in regulating the weight on the face; unless that is guarded, one is liable to throw all the weight on the face and crush the coal, or on the gob and thus lose the benefit of just enough pressure to break down the coal, when properly mined, without shooting. We think we have solved the problem in a small way, as shown in the character of the coal

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and the ease with which a practical miner can dig his four tons out of a 21-inch to 24-inch vein of coal.

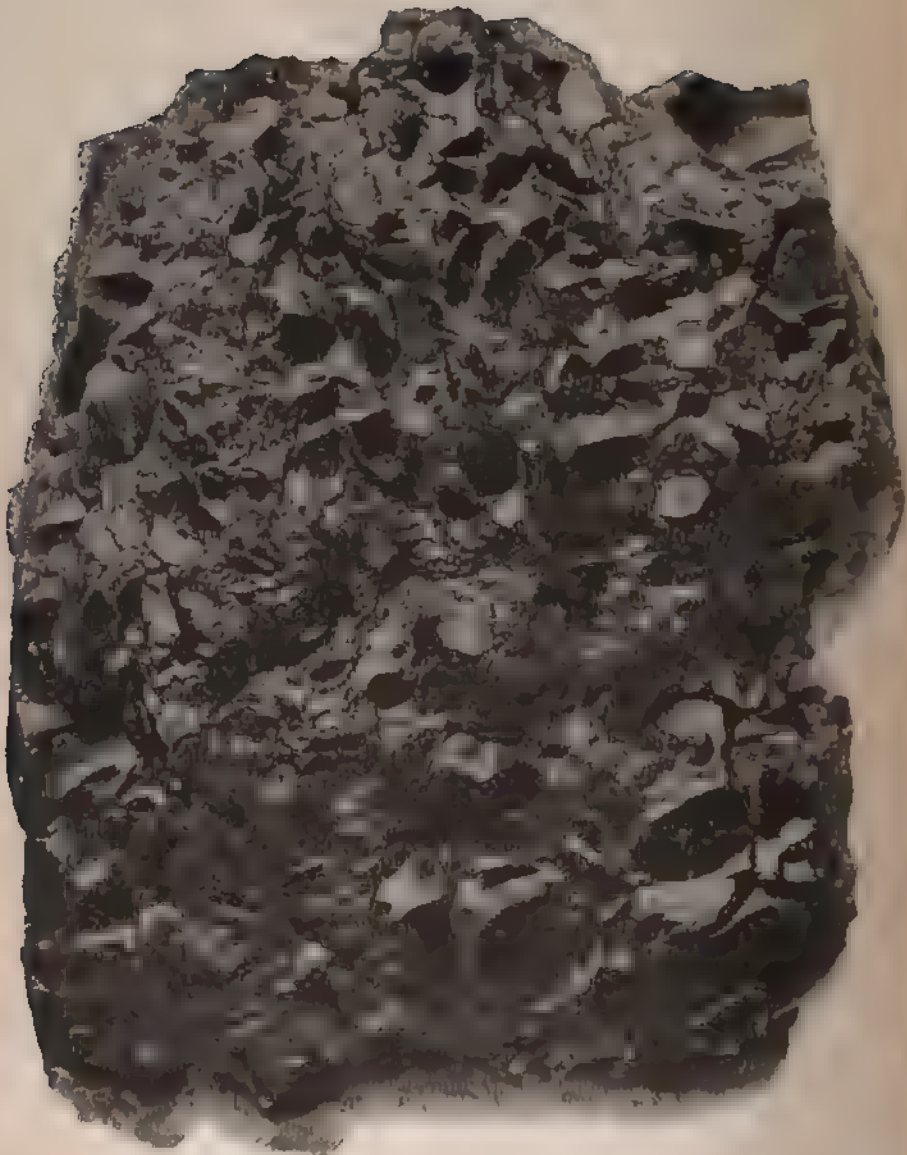
The advantages of Longwall in thin coal become very apparent when it is understood that under the pillar-and-stall method the amount of coal recovered seldom exceeds 100 tons per inch thick per acre. The theoretical tonnage which each acre of coal should produce is regulated by the specific gravity of the coal; thus, the specific gravity of "Jellico" coal is 1.26, and the theoretical tonnage contained in each three feet of coal per acre will be 5,147 tons. As before stated, it is seldom that over 3,500 tons per acre are recovered from a 3-foot seam, or a loss of about 1,500 tons per acre. Under the Longwall system there should practically be no loss. So we find that the two feet of "Blue Gem" worked on the Longwall plan yields, under the same specific gravity, 3,430 tons per acre. This increased production materially decreases the cost of production, in comparison with the pillar-and-stall plan, which seldom yields over 2,500 tons per acre in the Blue Gem mine.

In coal as thin as this seam, which necessitates the placing of all room roadways thirty feet apart and brushing same to secure a height of 39 inches in order to facilitate movement of cars and increase their carrying capacity, yardage or narrow work is necessarily more expensive than the pillar-and-stall plan, although nothing is paid for turning rooms, air-ways, or break-throughs, because all working places are turned wide, and the air is always at the working face. There is also a saving in timber, as the props, shown in Figure 3, are removed as soon as the space between them and the gob is filled with the slate brushed from the roadway. There is also an advantage in the concentration of workings, as most of the men on one side are within sight and sound of one another, as shown in the diagram. The advantages of ventilation and safety to the miner, added to the ease with which the coal can be mined under this system, on account of the pressure of the roof on the face of the coal, as shown in Figure 3, contribute materially to the desirability of this system of working. "Blue Gem" coal at this mine is very hard and could not be mined, except with

the aid of an excessive use of powder, on the pillar-and-stall plan. The cleavages of the coal are very favorable to Longwall mining; the butts and faces are very clearly defined, and as the vein is horizontal, the room workings are advanced at right angles to the face. Eighteen inches to twenty-four inches of mining across the face of the 30-foot working place, will yield next day four tons of very loose coal, the subsidence of the overlaying strata, during the night, having performed (when properly regulated) in a more effective manner the work of powder. The coal blocks 12 to 15 inches the thickness of the vein.

The relative cost of production between "Jellico" and "Blue Gem" does not vary in the ratio of their thickness, but it is safe to say that the difference is at least 25 per cent. in favor of "Jellico," so that the cost of producing a ton of "Blue Gem," mine run, is never less than \$1.25 to \$1.35 per ton, which necessarily makes it a very high-priced coal by the time it reaches the market, and precludes the possibility of producing in large quantities like the "Jellico," except for domestic and gas purposes.

The application of the Longwall method of working was not an experiment, except that this is the first attempt to do so in the "Blue Gem" vein. We do not anticipate any great results, but we believe that we have solved the method of working this vein in the most successful manner, and when we can raise the tonnage to about 250 tons per day, the results will without doubt be thoroughly satisfactory.



Birds-Eye Cannel Coal, Whitley County.

XII.**KENTUCKY'S MINERAL WEALTH.**

BY CHARLES J. NORWOOD.

A very common form of request for information concerning the general character of Kentucky's mineral stores received by this office is for "a geological report on the State." Unfortunately, save a brief, though admirable, account which was prepared primarily for distribution in pamphlet form nearly thirty years ago, there is no single publication, among the various reports issued by the State Geological Survey, which treats of the State as a whole, the work of the Survey not having reached the point, at the time annual appropriations ceased, when a sufficiently comprehensive report of the sort could be issued. But to in some measure satisfy the desire for at least a brief summary, a short chapter treating of our mineral resources in a general way was included in the reports of this office for 1894 and 1895. Although a number of the Geological Survey reports, which are now out of print, were then available for distribution, the many calls for the 1895 report soon demonstrated the usefulness of that chapter. In view of the exhaustion both of the Survey reports and the Inspector's report for 1895, and the present urgent demands upon the office for just such general information as the chapter was intended to supply, it is deemed desirable to reprint the chapter, and it is here given in somewhat revised form.

Kentucky has an area of 41,283 square miles, and within it there are, perhaps, less than 1,000 square miles unfit for agriculture, and less than 200 in irreclaimable swamp. It presents the unique picture of a solid sheet of farming surface underlaid, in large part, by mineral stores of exceeding value—the rare asso-

ciation of fertile soils with mineral deposits of notable extent and excellence. Prof. N. S. Shaler, for several years the distinguished Director of the State Geological Survey, speaks of Kentucky soils as follows: "The area of very fertile soil in the State—that which may be called of the first order—is about 10,000 square miles. This is equal in fertility to the best English, Belgian or Lombardian lands, and surpasses any other region in this country or in Europe for its fitness for pasturage land. It lies on a limestone rock, which by its rapid decay constantly restores to the soil the elements removed by cultivation, so that there are fields in Kentucky which have been steadily cropped, with no attention to fallow or fertilizer, for about one hundred years without apparent damage to the soil. No other land of the world is so fitted to withstand the evils of the utterly unscientific agriculture to which it has been submitted in former days. The area of second-class soils, those less fertile than the preceding, easily worn by careless tillage, still affording a good basis for agriculture, may safely be estimated at about 22,000 square miles; the distinctly inferior soils, those not well fitted for any grains without fertilizing, or for other agricultural use, save as low-grade pasture lands, and for timber, include about 7,000 square miles. There are not over 200 square miles of irreclaimable swamps and arid rocky fields; and not more than 800 square miles unfit for pasturage. Nearly the whole of the latter is forest clad, and with a little care could be made to produce good timber. It is doubtful if an equally good showing can be made for any other State in the Mississippi Valley, and there are few regions in the world where so large an area with so little waste land can be found."* Our soils should particularly interest the farmer of the Northwest. Here the soils are formed in place, constantly renewed by decay of the immediately underlying rock, and in rich, fine particles; whereas, the Northwestern soils are mostly of silicious "drift" material, a mixture of comparatively coarse sand, clay and gravel, hence less durable than are those of Kentucky, and when exhausted ser-

*Kentucky, a Pioneer Commonwealth, by N. S. Shaler; p. 30. Boston, 1885.

viceable only as planting ground for crops that must be fed by artificial fertilizers.

With a coal-field both to the east and to the west, Kentucky is the only State east of the Mississippi the central cities of which may draw their fuel supply from either hand, without passing beyond State lines. In acreage of hardwood forest it is a close second, if not first, among all the States, and it is notably rich in some of the softer woods. No State in the Union has so complete a system of natural water-ways, susceptible of being rendered navigable far up toward their headwaters. In wealth of limestones and sandstones fit for structural, architectural and sculptural purposes the State takes high rank. It is rich in iron ores of much excellence, most favorably placed with reference to fuel and flux and geographical position. It has extensive deposits of superior clays, fit for most of the uses to which clay is put; potter's and fire-clays of exceptionally high quality, and vitrifying brick-clays of proved excellence. In this respect it is but little less rich than Ohio, which leads in clay productions, and where the productive value of the clay industries now exceeds that of coal mining, which formerly stood first. In the Chester marls it has an abundant store of what may prove useful as a fertilizer, carrying phosphoric acid and potash, for deteriorating sandstone soils. It has considerable deposits of gypseous clays and extensive beds of paint-clays and ochres. It has in abundance the elements for the manufacture of soda-ash, cement (natural and Portland), terra-cotta, lumber and lime; notable stores of fluor-spar and barytes, carrying lead and zinc; beds of phosphatic limestones, sandstones and shales; beds of lithographic stone, some of which are of high value; regions of admirable glass sand, and of flint for mixing with clays; districts of natural gas of proved economic importance; large areas of bituminous sandstone ("asphalt rock"), of great excellence for paving and other uses to which such rock is put; and notably large fields of petroleum and of salt brines.

In its geological structure, Kentucky is singular among all the

States. Crossing the State southwestwardly from the position of Cincinnati is an uplift, exhibiting Lower Silurian rocks on the north and Lower Carboniferous beds on the south. Passing eastwardly from this geological ridge, we find beds of the Lower and Upper Silurian, Devonian, Lower Carboniferous and Coal measures coming successively to view; while on the west the same formations with the addition of Cretaceous, Tertiary and Quaternary deposits, form the section to the Mississippi river. To these conditions are due the great diversity of soils, from the blue-grass of Central Kentucky to the cotton lands of the Purchase, and the wide distribution of the ores, clays, coals, etc.

GEOLOGICAL SCALE.

The sequence of the formations, in descending order, together with a statement of the principal economic materials afforded by each, is as follows:

I. QUATERNARY.

Divisions are: 1. Alluvium and Brown Loam. Thicknesses variable. 2. Loess 20 to 30 feet (in "Jackson's Purchase").* 3. Port Hudson beds, 24 to 50 feet (in "Jackson's Purchase"). 4. The Gravel beds, of "Jackson's Purchase," 87 to 124 feet.

Economic Materials are: Refractory clays, road material (the noted "Paducah gravel"), pigments, very excellent iron ore (limonite), and moulder's "sand."

II. TERTIARY (in "Jackson's Purchase").

Divisions are: 1. Lagrange, 12 to 20 feet. 2. Lignitic, about 25 feet. 3. Porter's Creek, about 100 feet. 4. Hickman, 6 to 15 feet.

Economic Materials are: Fine pottery clays, glass-pot (?) clays,

*The region known as "Jackson Purchase" is that portion of the State which lies west of the Tennessee river. It forms part of the area purchased from the Chickasaw Indians through a Commission of which Gen. Andrew Jackson was a member.

lignite, gypseous clays (possibly available for cement), terra cotta clays, iron ore and glass-sand.

III. CRETACEOUS (in "Jackson's Purchase").

Divisions are: Ripley Sands, Ripley Clays—thickness about 100 feet.

Economic Materials are: Polishing material, fire-brick clays.

IV. COAL MEASURES.

Divisions are: 1. Lower Coal Measures, 800 to 2,500 feet. (Greatest thickness is in the Eastern Field. Thickness not accurately determined for either field.) 2. Conglomerate Measures, 0 to 1,600 feet. (Greatest thickness is in the Eastern field.)

Economic Materials are: 1. In Coal Measures.—Domestic, steam and coking coals, cannel, fire-clays, tile-clays, clays for common pottery, iron ores (carbonate), some good building stone.

2. In Conglomerate Series.—Bituminous coals (excellent), admirable building stones, pottery clays, cement clays, iron ore, salt brine, some bituminous sandstone ("asphalt rock").

V. LOWER CARBONIFEROUS (Mississippian Series).

Divisions are: 1. Chester (Kaskaskia) group, 400 to 700 feet. Possibly reaches a greater thickness in certain Western counties, and is feebly represented in certain Eastern ones. Consists essentially of thin bedded, frequently earthy, limestones, shales and sandstones. Base marked by the "Big Clifty Sandstone." 2. St. Louis group (probably Warsaw in part), 10 to 500 (or 800?) feet. Divided into Upper or Oolitic series,* and Lower or Geodiferous series. (a) Upper member consists essentially of oolitic beds alternating with drab to cream-colored, fine-grained, compact limestones—including the so-called "lithographic beds." Sandstone beds sometimes occur in upper part. Cherty beds come in towards the base. Beds frequently oleiferous. Yields a fine soil. (b) Lower member (the "Upper Silicious" of Safford in Tennessee), consists

*Mr. E. O. Ulrich, U. S. Geological Survey, divides this series of rocks into Princeton beds and St. Louis beds. It is probable that what is here called the "Lower Member" is in fact largely Keokuk. The inclusion of the entire series here indicated in the "St. Louis Group" is merely provisional, until the true relations of the lower beds may be more clearly defined than has yet been found possible.

essentially in dark blue, to coarse and dark gray, frequently fetid, limestones. Drusy cavities, lined with quartz or calcite crystals, numerous. Patches of calcite frequently distributed through the mass, and fluor-spar is rather a common occurrence. Galena sometimes found in cavities. Chert abundant, especially in lower beds, either as irregular bands or in concretions. Geodes common. Is well marked by prevailing blue color and geodiferous character.* 3. Keokuk-Waverly Beds.—(Logan and Cuyahoga, of Ohio, in part.) 200 to 500 feet. Most silicious and shaly towards the northeast; most calcareous and thick bedded towards the southwest and west. Is the "Lower Silicious" of Safford, Tennessee.

Economic Materials are: 1. In the Chester Group.—Potash marls ("Leitchfield marls"), vitrifying brick clays, pigment earths, bottle-glass sand, asphalt rock (large areas).

2. In the St. Louis.—Fine structural stones (white oolitic and blue), road material, street and paving material, lead and zinc, fluor-spar (extensive deposits), excellent iron ore (limonite), lithographic stone.

3. In the Keokuk-Waverly Series.—Tile and pottery clays, iron ore (carbonate), excellent building stones (including the noted Rowan county stone), mineral water springs, petroleum, gas.

VI. DEVONIAN.†

Divisions are: 1. Black Shale ("Chattanooga" of U. S. Geological Survey), 40 to 300 feet. The maximum exposed thickness is about 150 feet. The greater thickness has only been found in drilling oil wells in 1901 and 1902 in Morgan and neighboring counties. Mr. J. B. Hoeing reports the thickness as 280 feet in one of his Morgan county wells. Thickest in its northeastern extension.

*Ky. Geo. Sur., N. S. S., Dir., vol. i., pt. 6: "Geology of the Region Adjacent to the Louisville, Paducah & Southwestern Railroad," by C. J. N., 1875."

†The distinct separation of the Devonian from the Upper Silurian is here given provisionally and for convenience. The division is not sharply marked. The two formations merge into each other. The interval between well identified Corniferous and plainly recognized Niagara along the western rim was deemed L. Helderberg by the late Dr. Edward Orton.

2. Corniferous (probably L. Helderberg in part), 15 to 50 (?) feet; Oriskany, 1 to 3 feet.

Economic Materials are: 1. Petroleum, gas, salt brine, phosphatic nodules and layers, marbles for indoor work, cement rock.

VII. SILURIAN.

Divisions are: 1. Niagara, about 18 feet (probably 30 feet in the southwest). 2, Clinton, 25 to 50 feet. 3. Medina (?), 9 to 35 feet.

Economic Materials are: "Crab Orchard Salts," in Niagara shales. Building stones, paints, petroleum, oolitic hematite (Alabama "dyestone ore"), in the Clinton.

VIII. LOWER SILURIAN (Ordovician).

Divisions are: 1. Upper Hudson ("Richmond," of E. O. Ulrich), 270 to 300 feet. 2. Middle Hudson ("Silicious Mudstone" series), 150 feet. 3. Lower Hudson (L. Cincinnati), 175 to 200 feet. 4. Trenton, 175 to 185 feet. 5. Birdseye, 125 to 140 feet. 6. Chazy, 225 to 350 feet.

Economic Materials are:

1. In Hudson river series. Principally building stones and petroleum.

2. In Trenton. Excellent building stones, lead and zinc, barite (large deposits), considerable fluor-spar, phosphatic limestones (afford the "bluegrass" soils). Possibly petroleum.

3. In Birdseye. Fine building stones; lead and zinc; beautiful cream-colored marble for structural and sculptural purposes (this may be Chazy).

4. In Chazy. Some lead, barite, fine building stone, salt brine, "Blue Lick" water.

The surface areas of the various geological formations—the character of which determines the agriculture—are as follows:

Lower Silurian. Limestone, with occasional beds of calcareous shale. Includes the "Bluegrass Region." Forms "Central" Kentucky. About9,000 square miles.

Upper Silurian and Devonian. Coarse and silicious limestones and shales, with some cherty sandstone (Upper Silurian); and black bituminous shale, with some limestone (Devonian). Occur principally as a rim around the Central Kentucky region. The Devonian is brought up by the Pine Mountain fault in some of the Southeastern counties also; and in some of the South-central counties it is exposed by the down-cutting of the Cumberland river. About1,200 square miles.

Keokuk-Waverly Series of the Lower Carboniferous. Silicious shales with beds of silicious limestones, and fine-grained, close-textured sandstone. Occur principally in Allen, Monroe, Cumberland, Barren, Bullitt, Russell, Casey, Powell, Rowan and Lewis. Largest development is in the first four counties. About3,500 square miles.

St. Louis and Chester groups of the Lower Carboniferous. Principally limestones, many of them quite pure (St. Louis); with sandstones, marls and coarse, thin-bedded, earthy limestone above (Chester). Occur principally in Southern and Western Kentucky (in 25 counties), and in Rockcastle, Pulaski, Russell, Wayne and Clinton counties. Also in a narrow strip along the Pine Mountain fault. About9,000 square miles.

Coal Measures. Sandstones and shales. Occur in 20 counties in the western and in 33 in the eastern part of the State.....15,680 square miles.

More recent formations. (Cretaceous, Tertiary and Quaternary.) Loams, clays, sands, etc. Cover the counties west of the Tennessee river. About2,500 square miles.

It will be seen that in consequence of the diversity and peculiar distribution of its geological formations Kentucky is singularly rich in a mineral and agricultural way. When its great system of water-courses shall have been adequately improved, there can be no good reason why Kentucky should not become one of the great mining and manufacturing States of the Union.*

THE COALS.

Since they constitute our most important form of natural wealth, in any statement such as this the larger part must necessarily be given to descriptions of our coals. And since, despite the several publications that have been issued by the State, there are still numerous questions touching our coals upon which the public needs information, more space is given to a discussion of them here than otherwise would have been the case.

The State has an aggregate of 15,680 square miles of coal-bearing measures, disposed in two distinct fields, comprising a portion of the Appalachian in the east and a part of the Illinois or Central in the west. The areas of the fields are as follows:

Eastern field, square miles	11,180
Western field, square miles	4,500
Total square miles	15,680

A very large proportion of each field is productive. Each contains from nine to twelve workable seams above the conglomerate-sandstone series that lie at the base of the coal measures, and in the Eastern one there are from two to six beds (from one to three being workable) included in the conglomerate series.†

Coal occurs in 53 counties, and workable beds are found in fifty-one. Forty-five counties are either in whole or in large part covered with the coal-bearing measures, and in eight others there are outliers of considerable extent. Commercial mining is now

*The areas, except for the Coal Measures, have been roughly determined from the geological map issued by the Kentucky Geological Survey, 1891.

†See "Keys to the Coal Fields," report of this office for 1893.

conducted in twenty-four counties; thirteen in the Eastern field, and eleven in the Western one. Kentucky has, perhaps, larger areas of persistently workable high-grade bituminous coal than has any other State.

Coking coal (one to three seams) occurs in not less than ten counties in the Eastern field. In eight of them as high-grade coking coal is found as is known in this country. The most notable bed is the "Elkhorn" seam, which is developed in its greatest thickness—9 feet in some places—in Pike, Letcher, Floyd, Knott and Harlan counties. It has been traced as a thick bed over an area of not less than 1,000 square miles. This coal produces a coke containing from 92 to 94 per cent. of fixed carbon, from 5 to 6 per cent. of ash, and from seven-tenths to eight-tenths of 1 per cent. of sulphur. The coke is admittedly equal, and in some respects superior, to the best Connellsville fuel—the standard of this country. Results of analyses and furnace tests of the coke made from the Pineville extension of the coal have been given in previous reports of this office. Pineville coke is well known as one of the best cokes in the country. The Pineville coke is used for iron-making and copper smelting. In the same field are two or three other coking coals, one of them of proved excellence. This field of coking coal is in some respects more favorably situated with reference to cheap and high-grade iron ores, and principal points of consumption, than is any other coke field in the United States. It needs transportation facilities. In Boyd county, coke made from the No. 6 seam, of the Eastern field, is used at the Ashland iron furnaces.

In the Western field two excellent coking seams, remarkably persistent in thickness and quality, are found in seven counties. They are the beds from which coke is made in Hopkins, Union and Webster counties. The percentage of sulphur in the coke precludes it from the iron furnace, under present practice, but for domestic use and many manufacturing and certain smelting purposes it is all that need be desired.* The coke acts well in the

*See paper on Western Kentucky Coke, and note on neutralization of sulphur, by Mr. J. B. Atkinson, in 1895 report.

furnace, carries the burden well, and it is not unlikely that it will yet find service in blast furnaces running on pure ores. The present production of this Western Kentucky coke is used principally for lead smelting and domestic purposes.

Cannel of superior quality—much of it admirably suited for gas-making, and practically all of it valuable for domestic use—is found in sixteen or seventeen counties in the Eastern Field. Seven or eight of the coal horizons in that field carry cannel. These cannel beds, some of which are superior to the best cannels of Scotland, are remarkable, not only for their richness in volatile elements and their persistency, but for the high candle-power possessed by the volatile constituents. There are few examples showing less than 40 per cent. of volatile matters, while many yield 44, 50, and even 60 per cent., exhibiting at the same time low percentages of ash and less than 1 per cent. of sulphur.*

In the Western Field three of the coal beds, (Nos. 1, 5 and 11), not infrequently carry cannel in notable thicknesses, and of such quality as to enhance the value of the bituminous product mined with it. The richest known deposit of cannel (the Breckinridge), is found in this field.

WESTERN COAL FIELD.

Although the longest known field in a mining way, and the recipient of perhaps the larger part of the attention of the first Geological Survey, really less definite information has been given about the distribution, persistency and correlation of the coal seams here than is true of most of the beds in the less developed Eastern Field. It is now known that several of the coals have a wider distribution, and are more persistent as workable seams, than has hitherto been supposed. Indeed, observations made by myself during the last year of service on the State Geological

*See "Notes on the Cannel Coals of Kentucky," by Mr. Chas. Hendrie, in report of this office for 1893. Also "Appendix" to said paper, by C. J. N., page 152 of same report.

Survey (1879),* and especially within recent years, have shown that errors of more or less importance, but chiefly with respect to correlation, have been committed in every report that has been made upon this field. This is due, in part, to the fact that the geology is usually masked; in part to a misapprehension of the nature of some of the coal deposits; and in part to the fact that comparatively little work of a detailed character has yet been done in the field, nearly all of it having been expended upon general reconnoissances preparatory to more thorough examinations in counties. There are few hills of considerable altitude, and there are no deep gorges; bold exposures are rare, and the geology is much complicated by faults difficult to trace. It also seems probable that instances of unconformity occur in the northern part of the field, especially toward the Ohio river, in addition to those known on the eastern and southeastern borders.

The southern extension of the coal-field is marked by two prominent, approximately parallel, broken folds—usually faults—one of them at the border of the field and the other a short distance within it, which trend north of westwardly, and from which the rocks dip northwardly. The most notable disturbance within the field, however, is the "Rough Creek Uplift," (approximately parallel with those just mentioned), which brings up Lower Carboniferous rocks in the heart of the coal area, and trends across the field from Grayson county to Illinois.† In Ohio county, near the Grayson line, beds that may be even lower than the Lower Carboniferous are brought up. It follows an irregular line, passing north of Hartford, Ohio county; north of Calhoun, McLean county; by Sebree (south of town), Webster county; south of Morganfield, Union county, and thence in the direction of Shawneetown, Illinois, possibly being connected with the uplift in Gallatin

*Geological work then in progress in this field was suddenly suspended on account of the near exhaustion of Survey funds, and it was not resumed. The work thus being left in a fragmentary condition, the partial results obtained have not been published.

†Ky. Geo. Sur., N. S. S., Dir., vol. v., pt. 5: "A General Account of the Geology of a Part of Ohio County," by C. J. N., p. 137. Also vol. iv., pt. 7: "Examinations Made Along the Paths of the North and South Running Railways of Western Kentucky," by C. J. N., pp. 302, 311, etc. Ky. Geo. Sur., D. D. O., Dir., vol. 1, pp. 112 and 147.

county, Illinois, known as the "Gold Hill Axis." There are other noteworthy disturbances, but this is by far the most important one.

For most, if not all, of its length it is marked by a fault, and it has operated to diminish the total length of the section of coal measures—leaving us but little of the upper part of the column seen in Illinois.* On the other hand, however, it has served to retain within convenient distance from the surface in Kentucky, over a larger area than would otherwise have been the case, the best beds of the Central Coal Field.

What we have lost in consequence of the fold is of little moment; what we have gained, in having such a large area of the best coals near the surface, is of great importance. One of the results of the northward dip of the rocks south of the disturbance is the presence of the higher coals in the vicinity of the fold in a number of places, as in the region south of Sebree; while northward from the uplift the higher coals are again in evidence at several points on the Ohio river, as at Henderson and Evansville. The irregular trend of the uplift, and what may be called minor (though locally quite important) disturbances, which are sometimes faults, modify the structure of the area between this principal disturbance and the Ohio, so as to permit the lower coals to come to the surface along the river in parts of Hancock and Daviess counties; the general conditions prevailing in this coal-field, not now necessary to discuss, also serving to bring the lower coals to view in Ohio. Along the line of uplift, on the north, some excellent examples of the lower coals are brought up.

The difficulties and eccentricities of this field were discounted by officers of the first Geological Survey, and conclusions were reached which, proving erroneous in some instances, have been a source of confusion to all who have been unable to find a middle ground between the full acceptance of them and their total rejection. A number of the errors of the first Survey remain uncorrected and a large part of the field is, therefore, full of puzzles to

*It has been suggested that this uplift occurred before the deposition of the upper part of the section, and that the upper beds were deposited on its slopes.

the average prospector. Mr. A. H. Worthen, in Illinois, and Mr. E. T. Cox, in Indiana, have each offered "corrections" of the section constructed by Dr. David Dale Owen (founded upon observations made in Union county), to show the number and succession of coal-beds in this field.* Their efforts ended in the utter rejection of Owen's "Kentucky Section," and each gentleman presented a substitute. In doing this they committed grave errors which have only served to lead others astray. It is unnecessary to discuss their errors in detail; they have been pointed out in a preceding report.†

It is sufficient to say here that the principal coals of the Illinois section presented by Worthen correspond to the upper seams of the Kentucky column; that Nos. 5, 6 and 7 of Worthen's nomenclature correspond to Owen's 9, 10 and 11, and that there are really more than eight noteworthy coal beds below "No. 9" in our Western Coal Field. Mr. Cox founded his erroneous "corrected section," which limited the number of Kentucky coals to five, upon the incorrect supposition that he had found in the hills near Hawesville, Hancock county, the complete series of Western Kentucky coals. The highest coal shown in his section, said by him to be "No. 11," is in fact a coal that occurs between No. 4 and No. 3 of Dr. Owen (not numbered by the latter). Had Mr. Cox looked farther, he could hardly have failed seeing three other coals still above, in Hancock county, one of them, the Lewisport, being one of the most trustworthy coals in the county.

Errors certainly have been made as to the equivalency of beds in various parts of this field, but the results of investigations made in recent years, not only by myself but by other and careful observers, and made under the advantages offered by the increased development of mining, not only prove that there are, unquestionably, more than twelve coal-beds below the "Anvil-rock" horizon, but tend to verify the larger part of the Union county section constructed by Dr. Owen.

Of course no single section will serve, in detail, for all parts of

*For Owen's Complete Section see Ky. Geo. Sur., O. S., Vol. III. See, also, Reports of this Office for 1893 and 1894.

†Report of this office for 1893: "Keys to the Coal Fields."

the field, but Owen's section, which has been verified from "No. 12" coal down to "No. 5" inclusive, and in its principal features from "No. 1 B" up to "No. 4" inclusive—subject to some modifications of intervals here and there—may be accepted as a basis from which to work in the larger part of the field. The correct amount of interval between "No. 5" and the "Curlew Limestone," below "No. 4," is still an open question. Dr. Owen made it 114 feet in Union County and 122 feet in Illinois. Notes of a preliminary line of levels run by myself, in which dip was taken into account, make the distance 210 feet; but I am prepared to find that an error exists in the recorded notes. Borings made by the St. Bernard Coal Co. in Hopkins county, and measurements made in Hancock county, tend to verify Dr. Owen's figures, the interval growing less toward the east. One of the most important bits of geological work yet to be done in this field is that of determining the variations of the intervals between the coal beds and tracing the extensions of the several coals.

The Ohio county section presented in the reports of this office for 1892 and 1893 (but first published in 1877),* contains an error that has been overlooked from year to year. Sufficient space is not shown between coals F. and G. Later and more extended observations, made by myself, have shown that the interval should be from 140 to 160 (or 175?) feet (instead of 55 feet, as shown), and that two coals occur therein. The proper order of the beds, beginning with coal F., is as follows:

1. Coal F, (Owen's No. 7?), 9 to 18 inches.		Feet.
2. Space	0 to	2
3. Mottled limestone	1 to	2
4. Space	54 to	70
5. Coal Fa, observed 12 inches.		
6. Space	35 to	40
7. Coal Fb, observed 18 to 24 inches.		
8. Space	45 to	50
9. Coal G, 14 to 26 inches.		

With this correction, and used in conjunction with the Hancock County Section, the Ohio County Section will serve as a key for the eastern and southeastern portions of the field, excepting

*Ky. Geo. Sur.: "A General Account of the Geology of a part of Ohio County," by C. J. N., 1877.

those in the extreme southeast. For the latter part of the field, reference should be made to the sections of the Conglomerate series given on a succeeding page.

Following is a general section, showing the intervals between coals, for the entire field:

GENERAL SECTION.

No.	Coals and Intervals.	Feet	Inches
1	Limestone. (Madisonville)		
2	Sandstone. Observed	5	
3	Coal dirt. (No. 10 of Worthen's Illinois Section).	?	
4	Limestone and shale	20	
5	Space. (Possibly reaches 186 feet. Worthen's No. 9, from 6 inches to 8 feet occurs in this space)	117	
6	Coal. (No. 8 of Worthen's Illinois Section. Probably No. 18 of Owen.) Thickness observed . . 17 inches to		28
7	Space, including the "Anvil-rock" sandstone 35 to	56	
8	Coal A (No. 12). 1 inch to		60
9	Fireclay. usually	8	
10	Shale and sandstone 0 to	19	
11	Limestone. Sometimes absent. Sometimes 8 feet or more. Usually 2 to	8	
12	Coal B (No. 11). (No. 7 of Worthen's Illinois Section.) Has clay parting of from $\frac{1}{2}$ to 2 inches; occasionally 6 inches. Thickness (usually 72 to 78 inches), ranges from 82 inches to		84
13	Space 27 to	46	
14	Coal C (No. 10). No. 6 of Worthen's Illinois Section. Seems sometimes to be absent. Observed thicknesses range from 8 inches and 18 inches to.		32
15	Space 59 to	67	
16	Coal D (No. 9). Usually not less than 56 inches. From 56 inches to		64
17	Space. (Possibly reaches 90 feet	58	
18	Coal E (No. 8 P). Observed thickness		18
19	Space 25 to	30	
20	Coal Ea. (This, instead of preceding, may be Owen's No. 8.) Thickness from 14 inches to		20
21	Space. 30 and 40 feet to	46	
22	Coal F (No. 7). Thickness from 9 inches to		18
23	Clay. Sometimes 7 feet. Usually 0 to	2	
24	Limestone. Mottled. Usually 1 to	2	
25	Space. In Ohio county usually 54 feet. In Hopkins appears to be 70 feet. In Union it is said to be 84 feet. Say 54 to	70	
26	Coal Fa (No. 6). (No. 3 of Worthen's Illinois Section). Ranges from 12 inches to.		36
27	Space. 40 to	50	
28	Coal Fb (No. 5). (No. 2 of Worthen's Illinois Section). Ranges from 7 inches to		48
29	Space. In Ohio and Hancock counties. 45 to 50 feet. Appears to be 85 feet in Hopkins, and Owen puts it at 95 feet in Union. May be even more in Union. Say 45 to	85	

GENERAL SECTION—Continued.

No.	Coals and Intervals.	Feet	Inches
30	Coal G. (Probably No. 4 of Owen; thickness reported by him at 48 inches.) Observed thicknesses range from 12 inches to		26
31	Space. Ranges through 15, 20, 30 and 35 feet. Say 25 to	35	
32	Fossiliferous, earthy limestone. Frequently cherty. Coarse grained. Usually shelly. Called "Curlew" limestone by Owen. It is the Hawes Hill limestone of Hancock county; the Mannington or Petersburg limestone of Hopkins, and the Hartford limestone in Ohio county. Sometimes a large part replaced by calcareous shale. Thickness, from 2 to	12	
33	Space. Occasionally, but rarely, 15 feet, in which event beds belonging in part to No. 32 may be included. Usually is from 2 to	5	
34	Coal H. Usually has a clay parting. (Not numbered by Owen.) Is worked in Hancock and Ohio counties. Also seen in Hopkins and Union counties. Thickness from 6 inches to		48
35	Space. Ranges through 30, 40, 45 and 55 feet. Say from 40 to	50	
36	Coal I. (Not numbered by Owen in Kentucky. Called No. 3 by him in Illinois. Not numbered by Worthen in Illinois). Is worked in Hancock county and was worked at Mannington in Hopkins. Ranges from 12 inches to		36
37	Space. (May possibly exceed 75 feet in Union county). Has been measured at 40 feet, 45, 50 and 54 feet; say from 40 to	50	
38	Coal J. (Is Owen's "Ice House" Coal, which he calls "No. 3" in Union county, but "No. 2" in his Illinois Section. Not noted by Worthen in Illinois). Place noted by Moore in Hancock county, and worked (51 inches) in Ohio county, near Fordsville. Measured at 30 inches by self in Union. Measured 12 inches to 48 inches by Moore along eastern border of Coal field. Measured in Ohio by Triplett at 31, 48 and 58 inches. A coal, with partings, 72 inches thick in western part Ohio county may be No. J. Usually thin. Say from 12 inches to		58
39	Space. Varies much. In Hancock, 50 feet; in Ohio, 60 feet; in Union, 73 feet. Say 50 to	55	
40	Coal K. (Called No. 1 C by Owen in Illinois, but No. 2 in Kentucky.) Is worked in north part of Ohio county. Is usually thin (18 to 30 inches) but reaches 60 inches. Is sometimes split, with parting reaching 60 inches in thickness. Say from 18 inches to		60
40	Space. Varies much, ranging through 40, 45, 50, 60 and 80 feet. Most commonly from 45 to	50	
41	Coal L (No. 1 B.) Thickness varies much, from 12 inches to		48
42	Space. Varies much, from nothing to probably	200	
43	Subcarboniferous (Chester) rocks		

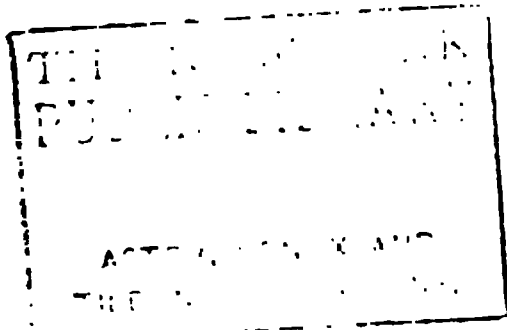
The complete succession of the measures above Coal A. (No. 12), has not been worked out. The foregoing section, therefore, does not purport to begin with the topmost rock. It is not believed that it includes the coals at Henderson and Evansville.

The accompanying plate is presented as a key to be used in connection with the foregoing section in the eastern part of the field; the reader being reminded, however, of the correction that must be made in the Ohio County Section for the space between coals F and G. The third coal from the top in the Hancock County Section is No. G; and the place of coal F is about 60 feet above the top coal of same section, which is F^a.

As has been stated above, the succession of the beds above Coal A (No. 12), has not been satisfactorily determined. It seems probable that the coals opened near Hanson, in Hopkins county, and at Sacramento, in McLean county, are above the "Anvil-rock" horizon, and I am now inclined to believe that the seam worked at Henderson and at Spottsville (usually regarded as "No. 9"), and the one mined at Corydon, in Henderson county, also belong in this series. Otherwise the measures above Coal A do not seem to carry any coals of special value in Kentucky. Beds belonging to this series may be seen at South Carrollton, Muhlenberg county; at Lewis Creek tunnel and around Rockport, Ohio county; on the high points about Madisonville, Hopkins county; and in Union county.

Coal A (No. 12).—This is an excellent coal when well developed, but is seldom found in suitable thickness for mining. When present at all, it varies from 36 inches to 72 inches in thickness; sometimes appearing as a mere smut, as at DeKoven, Union county, and sometimes reaching 80 inches, as in one of the slopes at the Pierce mine, in Muhlenberg county. It seems to thicken south-eastwardly from Illinois, where it is of no importance. It is finely developed near Paradise, in Muhlenberg county, where it is of very excellent quality. Following is an analysis of the general average of the coal when well developed:

	Per cent.
Moisture	4.15
Volatile combustible matter	33.14
Fixed carbon	55.71
Ash	7.00
	<hr/>
Sulphur	1.873



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In some examples the ash is as low as 4 per cent., and the sulphur reaches as high as 4 per cent.

Coke of good quality has been made from this coal, at Airdrie. Following is an analysis of average samples that had been exposed to the weather for seventeen years:

Moisture at 212°	7.50
Moisture at red heat	4.20
Fixed carbon	82.90
Ash	5.40
<hr/>	
Sulphur	0.64

The coke was made in an open heap, was not so good as could have been made in an oven, and, of course, had absorbed much water after so long an exposure to the weather.

Coal B (No. 11).—This is one of the principal sources of commercial fuel in this field. It corresponds to No. 7 of Illinois, and is there known as the “Danville Seam.” It is a persistent coal, but not reliable as to thickness, the latter ranging from 12 inches to 84 inches. It always has a clay parting, varying from ¼-inch to 2 or 3 inches, and is usually much cut up by clay slips and disturbed by rolls. Its greatest development is, perhaps, in Hopkins county, where it is thick (reaching 84 inches with but little parting) and pretty uniform, but still troubled with rolls and slips. In Ohio and Muhlenberg counties it shows thicknesses of 48 and 60 inches, and at the Pierce mine is 78 to 79 inches thick. Following is the bed section at the latter place:

	Inches.
a. Coal	17
b. Slaty parting 1 inch to	1½
c. Coal	28
d. Clay parting 1½ to	2
e. Coal	31½
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	79

In Union county it is very variable, seeming to present its poorest development in the western part of the county. In the eastern part, however, especially about Uniontown, it is a valuable coal, excellent in quality, and of admirable thickness. The upper part

of the bed is occasionally cannel—usually of rather poor quality. This feature has been noted in Muhlenberg and Union counties. Near the Syers bank, in the latter county (near DeKoven), the bed is only 33 inches thick, with the following stratification:

	Inches.
a. Cannel	14 to 15
b. Slaty coal	4
c. Hard "slate" and clay	10
d. Bituminous coal	4
	<hr/>
	33

In Vermilion and Gallatin counties, Illinois, I have found the thicknesses to range from 36 to 90 inches, the more common thickness being 48 to 64 inches.

The following analyses will give a fair notion of the general quality of the coal:

	1.	2.	3.
Moisture	1.30	3.32	3.31
Vol. comb.	36.51	37.73	36.76
Fixed carbon	52.25	51.41	50.20
Ash	6.93	6.78	9.63
	<hr/>	<hr/>	<hr/>
Sulphur	2.84	2.78	3.17

No. 1, average of three analyses of whole bed. No. 2, average of four analyses of top 3 to 4 feet. No. 3, average of three analyses of bottom 24 to 28 inches.

There are better examples of the coal than those of which the above analyses were made, but it is seldom that any are found inferior to them. This is one of the beds from which coke is made at Earlington, Hopkins county.

Coal C (No. 10).—This is a very erratic coal in Kentucky, and has not been seen as a workable bed anywhere in the central and eastern portions of the field. It is seldom present as more than a thin smut in the larger part of the field, but has been found presenting a thickness of 30 inches at the old Richmond mine, in Muhlenberg county. It is worked at the Syers bank, near DeKoven, Union county, where it ranges from 30 to 36 inches, usually

measuring 35 inches. The last mining done in the old Curlew mines was in this coal, near the present Syers bank.*

In Illinois this is one of the principal mining seams, and is there known as the "Grape Creek" Coal of Vermilion county. There it usually has a clay parting, is sometimes thinly capped with cannel, is a superior coal, and ranges in thickness from 36 to 96 inches. Following are measurements made by myself in 1881: In the Ohio shaft, Vermilion county, 80 inches; McKee mine, on Grape creek, 86 and 96 inches; No. 1 drift of English mine, on Grape creek, 73 inches; near the old Jewett opening, Saline mines, in Gallatin county, 36 to 38 inches. It appears that the coal thickens northwestwardly, and there is little probability that it will be found in important thickness in Kentucky.

Coal D (No. 9).—This coal is the most regular in bedding, the most constant in thickness, and the freest from "troubles," of any in the field—perhaps of any in the State. It is, in fact, a remarkable coal, wonderfully uniform in all respects. Probably 75 per cent or more of the commercial product of the Western District is derived from this seam. Wherever the disposition of the measures is such as to include this coal horizon, the bed will be found in workable thickness. It is rarely found less than 56 inches thick, is very frequently 60 inches, and not infrequently reaches 66 inches. It is one of the beds coked at Earlington. Following are variations in its composition: Moisture, from 2.32 to 4.30; volatile combustible matters, from 35.00 to 37.68; fixed carbon, from 50.57 to 54.36; ash, from 6.50 to 7.50. Sulphur ranges from 1.31 to 2.89, and has been found as high as 3.60 per cent.—the latter being abnormal. Following is an average of four analyses showing the general character of the coal over an extensive territory:

	Per cent.
Moisture	3.58
Volatile combustible matter	36.09
Fixed carbon	52.85
Ash	7.47
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Sulphur	2.09

*The Curlew mines were not in the Curlew (or Indian) hill, as is generally supposed. The original mine was in Coal D, or No. 9 coal.

Coals E and Ea.—One of these coals corresponds to Owen's No. 8, but which one has not been satisfactorily determined. So far as known, they are of no economic importance at any point in the field.

Coal F (No. 7).—This bed has nowhere been found in workable thickness. It was doubtfully suggested in a preceding report that the Lewisport coal, of Hancock county, might occupy this horizon; but it is now clear that that coal belongs at a lower level.

Coal Fa (No. 6).—This is the "Three-foot" coal worked at DeKoven by the Ohio Valley Coal and Mining Co. It is probably the third coal (30 inches) passed through in the St. Bernard Coal Co.'s boring at Earlington, and it is found in Hancock county at about fifty feet above the Lewisport seam. The greatest thickness exhibited by the bed at DeKoven is 41 inches; the least thickness known there is 32 inches. It appears to be a very uncertain coal in the eastern part of the field. In Hancock county it was found in a well on Wm. Richardson's place, showing a thickness of 18 inches.

Trustworthy analyses of the coal, to show its average composition, are not at hand. I am indebted to Mr. J. B. Atkinson for the following analysis of coke, which he made from selected or washed samples of the coal:

	Per cent.
Moisture, etc.	5.235
Fixed carbon	83.913
Ash	10.849
	<hr/>
	99.997
Sulphur	2.784

Coal Fb (No. 5).—This is the "Four-foot" coal worked by the Ohio Valley Coal & Mining Co., near DeKoven, Union county. In some parts of the mine the bed has an average thickness of 50 inches. Its maximum thickness there is 54 inches, and its least, so far as known, is 32 inches. Where found in its least thickness

at DeKoven the bed is in part cannel, the latter occurring about the middle of the bed thus:

	Inches.
a. Bituminous coal	6
b. Cannel	20
c. Bituminous coal	6
	<hr/>
	32

This bed is also the one worked at the Conn mine, near Sturgis, Union county. In Hancock county it is known as the "Lewisport Coal," and is worked at a number of points. There it ranges from 36 to 48 inches, occasionally reaches 54 inches and usually is not less than 48 inches. This is probably the fourth coal (7 inches) passed through in the Earlington boring, Hopkins county. Trustworthy analyses to show the average character of the coal in Union county are not at hand. Following is an analysis of samples collected by Mr. P. N. Moore at the Robert Estes bank in Hancock county:*

	Per cent.
Moisture	3.50
Volatile combustile matters	43.40
Fixed carbon	45.56
Ash	7.54
	<hr/>
Sulphur	4.155

It is very probable that Mr. Moore was severe in his sampling, and that an analysis of average samples of the marketable coal would give more satisfactory returns.

Following is an analysis of coke made from the DeKoven "Four-foot" bed, kindly furnished by Mr. J. B. Atkinson:

	Per cent.
Moisture, etc.	0.846
Fixed carbon	86.993
Ash	12.161
	<hr/>
Sulphur	2.807

*Ky. Geo. Sur., N. S., vol. iv., pt. x.: "On the Geology of Hancock County," by P. N. Moore.

Coal G (No. 4).—I have seen but little of this coal, and doubt that it is of much economic importance. It occurs in Indian (Curlew) Hill, near DeKoven, Union county, where I have examined the outcroppings, above a limestone which I understand to be Dr. Owen's typical "Curlew limestone." The limestone will here be referred to as the Indian Hill limestone.* In Hancock county the coal occurs from 20 to 30 feet above the Hawes Hill limestone in the easterly portion of the county, while in the western portion the interval varies, in short horizontal distances, from 30 to 45 feet—ranging through 30, 35, 32, 40 and 45 feet. In Ohio county it occurs about thirty feet above an equivalent limestone, and in Hopkins it is to be found at about the same distance above the Mannington (Petersburg) limestone. Dr. Owen reported a thickness of 48 inches in Indian Hill; but wherever seen by me the bed does not exceed 38 inches, the usual thickness seen being not more than 14 to 18 inches. The coal has been worked in Hancock county by Smith & Ford, in the vicinity of Petri Station.

Coal H.—This coal was not numbered by Dr. Owen. He indicates its presence, with a question, in his Union county section, at about 5 feet beneath the Indian Hill (Curlew) limestone. I have failed to find it in Indian Hill, but do not doubt its presence there. In Hancock county it is a prominent but variable coal, frequently exposed below the Hawes Hill limestone, which is plainly the equivalent of the Indian Hill limestone of Union county. Mr. Cox supposed this coal to be "No. 11," and it is so called by some persons in Hancock county. It is the seam which has been worked in the Hawes Hill at the old Lawson (more recently Cooper & Adair) bank, and at Bruner's, Adams' and other small banks in Hancock. Mr. P. N. Moore reports it as the coal worked at the Duncan bank, near Friendly Grove school-house, Daviess county. In Hancock county the interval between the coal and overlying limestones varies from a few inches to ten or twelve feet. In Ohio the distance ranges from 5 to 15 feet. The coal when present in

*It is possible that a higher limestone was sometimes confused with this limestone by Dr. Owen and assistants, and also referred to the Curlew.

notable thickness usually has a clay parting, which ordinarily is not less than 2 inches and is sometimes 12 inches thick. In thickness the bed varies from a mere smut to 48 inches, measurements ranging as follows: 10, 24, 25, 30, 32, 38, 44 and 48 inches. The coal at the Duncan bank, in Daviess county, referred to this horizon by Mr. Moore, is stated to be 48 inches thick without a parting. The changes in thickness sometimes occur in short horizontal distances. Following is a bed-section of the coal at the Cooper & Adair bank, near Hawesville:

	Inches.
a. Coal	6 to 8
b. Clay	8 to 12
c. Coal	24 to 24
	<hr/>
	38 to 44

In Hopkins county the overlying limestone is seen at Mannington and at a number of points west of that place. The Mannington seam lies at 32 feet below the limestone, and has been supposed to occupy a lower horizon than H; but the general character of the bed indicates that the proper correlation is with this coal. The Terry and the Virgil Hamby coals, in southern Hopkins, being equivalent exposures of the Mannington coal, also belong at this horizon. The coke made at the Clifton coke plant, now idle, was made from this coal.

Following are analyses of the coal, and of cokes made from it:

Analysis of Coal:

	1.	2.	3.	4.
Moisture	5.40	3.70	....	....
Vol. comb	34.80	32.56	....	....
Fixed carbon	49.30	50.04	47.45	52.53
Ash	10.50	13.70	16.02	10.31
	<hr/>	<hr/>	<hr/>	<hr/>
Sulphur	2.398	3.716	3.21	1.92

1. Analysis by Peter of the Lawson coal, Hancock county, sampled by P. N. Moore. 2. Analysis by Peter of Mannington coal, sampled by myself. 3. Partial analysis by Stutz of unwashed Mannington coal. 4. Partial analysis by Stutz of washed Mannington coal.

Analysis of Cokes:

	1.	2.	3.	4.	5.
Moisture	1.056	1.28	1.62	2.929	1.530
Vol. comb. ..	.....	.....	.....	.....	1.189
Fixed carbon	80.402	83.14	83.42	91.676	89.285
Ash	18.542	13.60	12.94	5.395	7.996
Sulphur	2.567	1.98	2.02	1.399	1.464

No. 1. Mannington washed, coke by J. B. Atkinson. Analysts, Booth, Barrett & Blair. No. 2. Mannington washed, coked by J. H. Allen. Analyst, Mr. Stutz. No. 3. Same. Analyzed by Dr. J. M. Safford. No. 4. Terry, selected. No. 5. Edmunds, selected. Latter two coked by J. B. Atkinson, and analyzed by Booth, Barrett & Blair.

All things considered, while this coal frequently occurs in workable thickness, is found over a wide area, and is often locally valuable, it is not a trustworthy bed. It seems to be at its best in southern Hopkins county.

Coal I.—This bed is not numbered in Owen's Union County Section, but it is indicated as "No. 3" in his section for Gallatin county, Illinois.* It is the Mason coal of Hancock county, now worked at the Falcon mine, and the upper coal of the section at Kelly's, Ohio county, is probably at the same level. In Hancock county its position below the fossiliferous limestone overlying Coal H varies from 30 to 53 feet, Coal H being quite close to the limestone when the shorter interval prevails. As has been intimated, the stratigraphical position of the Mannington coal below the limestone at Mannington would strongly suggest the correlation of that coal with "I," instead of with "H;" but other circumstances indicate to the contrary. It is possible that "I" is thin in the Mannington region, or that the two coals are closer to each other there than in the northeastern part of the field. In Hancock and Ohio counties the coal ranges from 30 to 42 inches in thickness, the average being about 36 inches. Following is an analysis of the Mason coal, sampled by Mr. P. N. Moore.

*Report of the President and Directors of the Saline Coal and Manufacturing Company, 1855.

	Per cent.
Moisture	4.80
Vol. combustible matters	38.90
Fixed carbon	50.06
Ash	6.24
	<hr/>
Sulphur	2.316

Coal J.—This is the “Icehouse” coal of the DeKoven region, and is called No. 3 by Dr. Owen in his Union County Section, but No. 2 in his Illinois Section. The thin coal seen at about 40 to 50 feet below the Mason coal in Hancock county occupies this horizon; and in Ohio county the Worrall Mountain seam and the Gaines coal may be at the same level. It does not appear to be of more than local value, as at Fordsville and Reynolds Station. Mr. Moore also reports a thickness of 48 inches in places.* So far as known it is usually not more than 30 inches thick.

Following is an analysis of the Fordsville coal; samples collected by P. N. Moore:

	Per cent.
Moisture	6.10
Volatile combustible matter	37.50
Fixed carbon	50.46
Ash	5.94
	<hr/>
Sulphur	1.310

Coal K.—This appears to be the bed numbered “2” by Dr. Owen in his Union county section, and “No. 1C” in his Illinois section. The coal (“Deaneffield”) worked at Aetnaville, Ohio county, seems to occupy this horizon. As seen at Millwood, Grayson county, and elsewhere along the eastern border of the field, it varies from 18 to 30 inches in thickness. It is an uncertain bed, and does not have much value in the western and southwestern portions of the field. The Deaneffield seam is quite eccentric, having a parting which may suddenly swell from a streak of slate to a sandy bed more than 5 feet thick, and then as suddenly diminish to a mere division plane. Following is an analysis, by Dr. R. Peter, of samples of the Deaneffield coal sent by Hon. R. S. Triplett:

*Ky. Geo. Sur., N. S., vol. iv., pt. xi.: “Region adjacent to the Eastern Border of the Western Coal Field,” by P. N. Moore.

	Per cent.
Moisture	4.78
Volatile combustible matters	35.22
Fixed carbon	49.40
Ash	10.60
<hr/>	
Sulphur	1.39

Coal L (1 B).—This is the coal opened at Barnaby & Son's mine, Crittenden county; the "main coal" formerly worked at Hawesville, and it is probably the one worked at Mud River, Empire and Aberdeen mines. It is the "Main Nolin" coal of Edmonson county, and is there, at places, an inter-conglomerate bed, the "Bee Spring Sandstone," above, sometimes appearing as a lean conglomerate. The coal frequently carries considerable cannel. In thickness it varies from 12 to 48 inches, rarely reaching 54 inches.

Following are analyses of the coal and of coke made from it:

Analysis of Coal:

	1.	2.	3.	4.
Moisture	4.85	2.48	8.00	3.30
Volatile combustibles	32.22	34.04	34.36	39.00
Fixed carbon	55.03	55.50	54.24	50.50
Ash	7.90	4.00	3.40	7.20
<hr/>				
Sulphur	1.373	0.80	0.876	3.373

1. Empire coal. 2. Mud River coal; average of two analyses by Peter. 3. Mining City, Butler county, coal. 4. Main Hawesville coal; severely sampled by P. N. Moore. Sulphur in this coal varies from 1.368 to 4.038, in samples taken from coal as it lies in the bed. Latter percentage is abnormal.

Analysis of Coke. (Courtesy of J. B. Atkinson):

	1.	2.	3.
Moisture	1.015	0.655	1.815
Fixed carbon	87.666	92.988	89.297
Ash	11.319	6.357	8.893
<hr/>			
Sulphur	1.533	1.215	2.356

1. Bell coal, of Crittenden county. 2. Parker coal, equivalent of Empire, Hopkins county. 3. Same coal from another opening a short distance from No. 2. All coke made by Mr. J. B. Atkinson from clean coal. All analyses by Booth, Barrett & Blair.

THE CONGLOMERATE MEASURES.—Comparatively little is known concerning the conglomerate sandstone series of the Western Field. They present the characteristic variableness and eccentricities—the rapid, often abrupt, thickening and thinning of beds, sudden changes in the nature of the rocks, and the exceeding inconstancy of associated coal beds—that are to be noted in all regions composed of such strata.

Anything like a particular and accurate study of the series in this field has been made in only one small district—that portion of the coal area lying within Edmonson and Grayson counties. Mr. P. N. Moore, in his interesting report on that district, separates the region into two parts, with respect to the conglomerates and coals: A region of heavy conglomerate sandstone, principally in the south, where the rocks and coals are especially erratic; and a region of thinner conglomerate and more constant beds, towards the north, included in the space between Bear creek on the west and the Nolin river and Rock creek on the east.*

Following is Mr. Moore's General Section, "east of Bear creek and north of Beaver Dam and Pigeon creeks, Edmonson and Grayson counties:"

	Feet.
1. Clay shale with nodules of iron ore	35 to 35
2. Iron ore, reported thickness	1½ to 1½
3. Clay shale	30 to 30
4. Iron ore	2 to 3½
5. Space. Probably clay shale	15 to 15
6. Clay shale	15 to 15
7. Coal	8 inches.
8. "Bee Spring" coarse sandstone. Sometimes a conglomerate. (The "5th Sandstone" of Lyons—Owen's Report)	20 to 60
9. Sandy clay shale	0 to 20
10. Coal	12 to 24 inches.
11. Shaly sandstone, changing to shale	15 to 20
12. Space, probably filled with clay shale	15 to 20
13. Main Nolin coal	24 to 40 inches.
14. Fire-clay and shale	3 to 10
15. Conglomerate sandstone	15 to 25
16. Shale	0 to 25
Top of Chester Group.	

*Report on the Geology of the Nolin River District, etc., Part 2, Vol. II., Geological Survey Reports, N. S. Shaler, Director; 1877.

Concerning this, Mr. Moore says: "This section applies very well for the most of the region between Nolin river and Bear creek; also for the region between Bear and Rock creeks, except at the very edge of the coal measure rocks, where there is some thinning out. It will also answer for a portion of the country east and south of the Nolin river."

Difficulties were encountered, of course, in attempting to obtain a general section for the "heavy conglomerate" region. Only one section of much vertical extent was obtained. This was made at Stevens' coal bank, on Bear creek, and is as follows:

	Feet.	Inches.
1. Covered, probably sandstone	35	..
2. Iron ore .....	..	6
3. Shale	3	..
4. Coal (reported) .....	..	14
5. Covered	5	..
6. Sandstone	20	..
7. Shale	40	..
8. Sandstone	4	..
9. Covered, probably shale	18	..
10. Coal (Main Nolin) .....	..	36
11. Fire-clay	2½	..
12. Conglomerate*	50	..
Bed of Bear Creek.		

The Main Nolin Coal (sometimes locally known as the "Tarlick Coal"), is the only known workable bed in the series in this district. It is the equivalent of No. 1 B of Dr. Owen (L of the present writer). It appears here as inter-conglomerate coal, a fact to be borne in mind when considering the lower coals of Union county. The normal distances of the three coals, shown in the general section, above the Chester limestone—which is the most trustworthy datum level—are: Main Nolin, 20 to 30 feet; second coal, 60 to 70 feet; third coal, 130 to 140 feet. The prospector among the lower coals of the Western Field will find it well worth while to study Mr. Moore's report.

Very little satisfactory work has been done among the conglomerate beds on the western margin of the coal-field. The following section, made by the present writer in Livingston county (at the Trabue mine), and published in his report on the lead region of that and adjoining counties, may be interesting:†

*This rock sometimes thickens to 190 feet.

†Part 7, Vol. I., Geological Survey Reports, N. S. Shaler, Director, 1875.

1. Conglomerate sandstone	20
2. Covered (shale?)	5
3. Thin-bedded, slabby sandstone	5
4. Shale	0 to 1½
5. Coal	4
6. Underclay	2½
7. Covered	10
8. Lower conglomerate sandstone; pebbly character, however, is rare	35
9. Covered to the Ohio river, about	100

At the river the upper Conglomerate exhibits a thickness of 40 to 50 feet, and the lower one shows a thickness of 40 feet. Col. Trabue stated, at the time the section was made, that a coal of 18 inches had been seen just above the upper Conglomerate. The upper Conglomerate becomes thinner in the direction of Carrsville, up the river, while the lower one shows a thickness of 100 feet.

THE EASTERN FIELD.

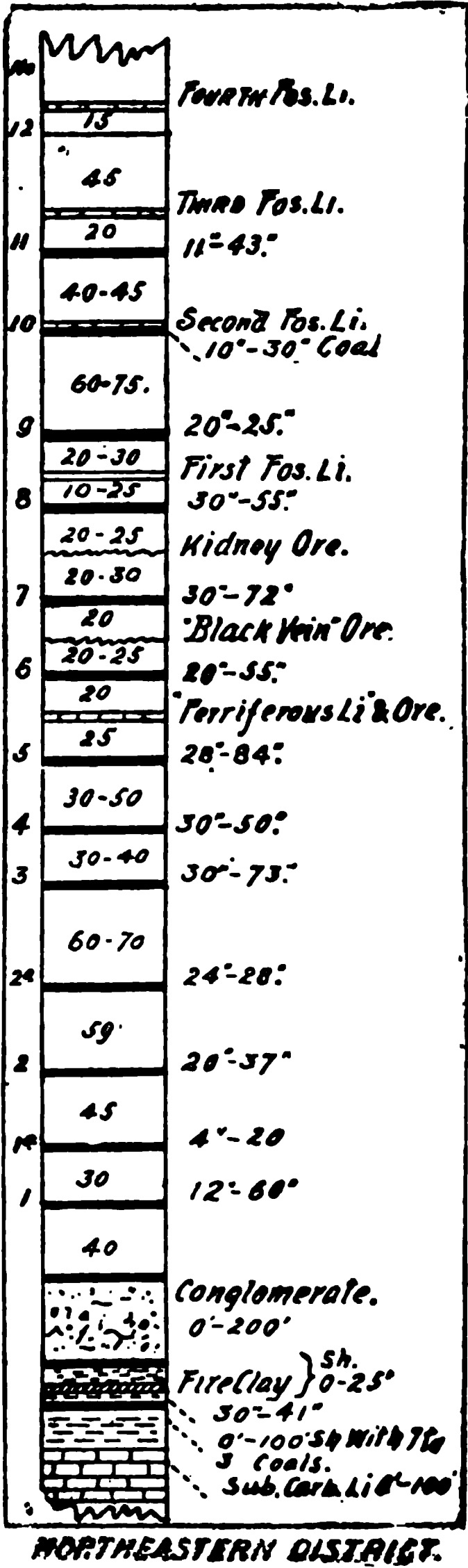
The Eastern Field has been divided, with reference to present and future mining, into three Inspection Districts, namely, the Southeastern, the Northeastern and the Elkhorn.

The Northeastern District. This District includes the counties of Boyd, Breathitt, Carter, Greenup, Johnson, Lawrence and Lee, in which commercial mines are at present in operation; and the counties of Elliott, Estill, Martin, Magoffin, Menifee, Morgan, Powell, Wolfe and Rowan.

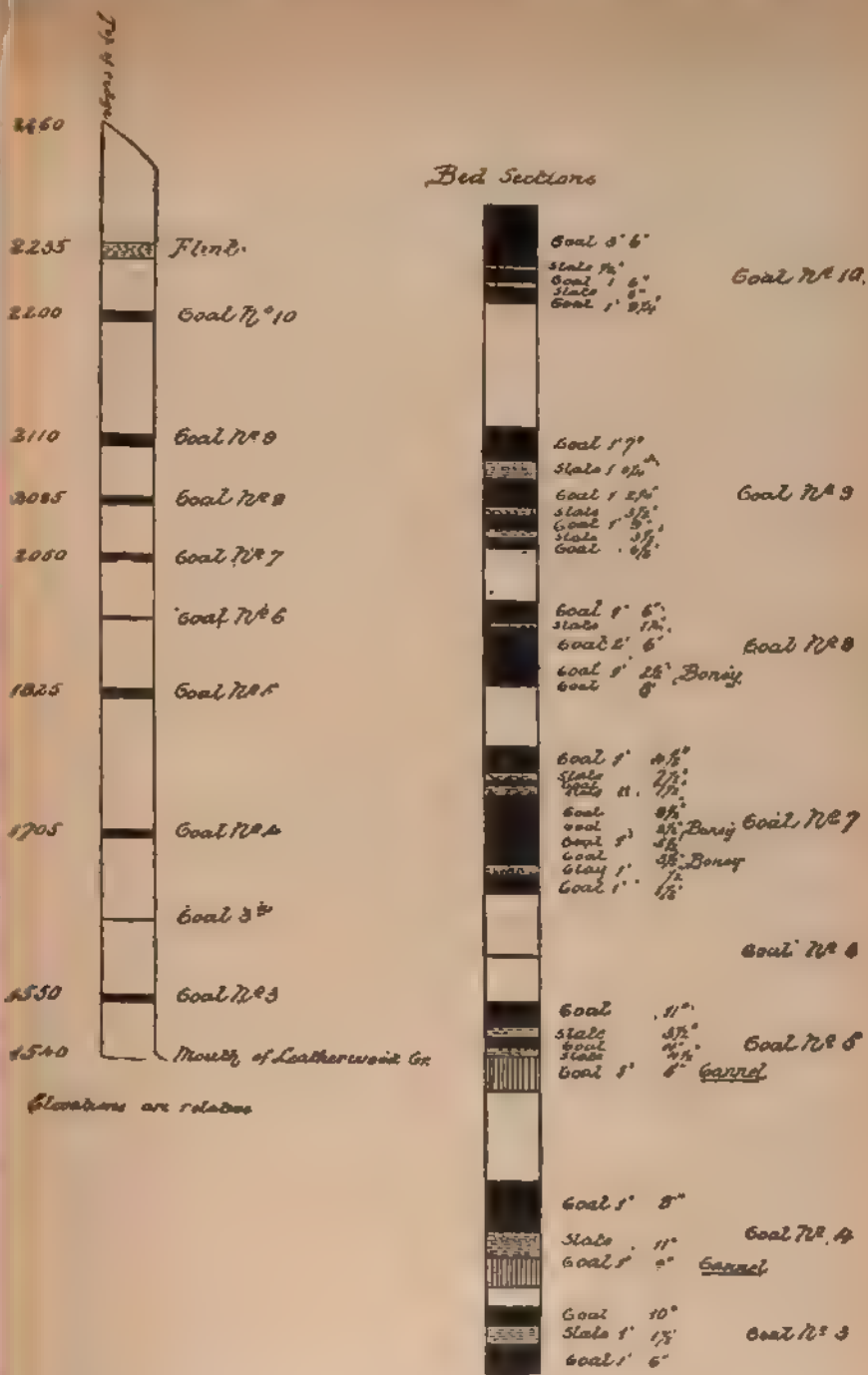
The accompanying General Section* will serve not only as a key to the coals of this District, but as a type section for the Eastern Field. It is founded on a condensed compilation, with some additions, of the "General Section for Greenup, Boyd, Carter and a part of Lawrence counties," constructed by Mr. A. R. Crandall, and published in Volume II, Kentucky Geological Survey Reports, N. S. It is subject to modification here and there, in certain parts of the field, especially in the direction of Pine Moun-

*Scale, 150 feet to the inch.

tain, but as a type with which comparisons may be made, and upon which other sections may be correlated, it is applicable

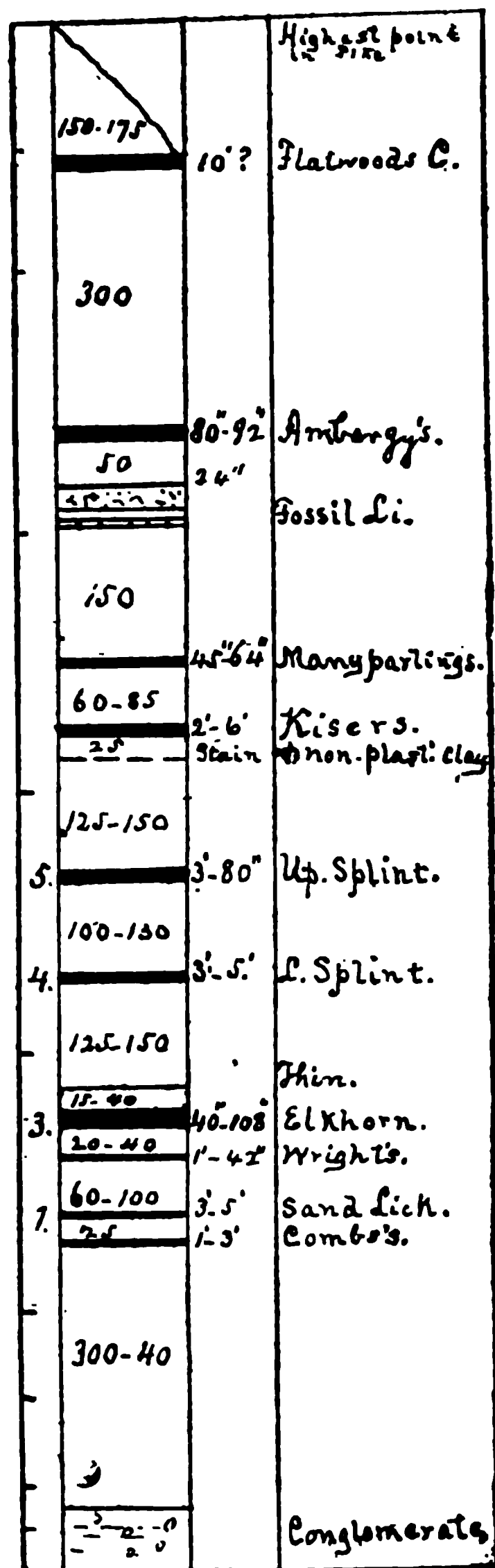


to the whole field. Compare this Section with the one for Flint Ridge, in Breathitt county, given in Mr. Charles Hendrie's paper on "Cannel Coals of Kentucky," published in the report of this office for 1893. Mr. Hendrie refers to the section as follows: "At the head of Leatherwood and Russell creeks (Breathitt county), the mountain rises to a height high enough to carry all the coals up to and including No. 10 of the geological series. . . . This mountain, known as Flint Ridge, takes its name from a peculiar deposit of flint, about 35 feet thick near the top. It is one of the highest points in Breathitt county, and the only one which attains a height sufficient to carry these coals. For this reason, the section and bed sections will prove interesting, as showing over 500 feet of strata in one of the most interesting portions of the Eastern Kentucky coal field." The Flint Ridge section is given on the accompanying plate.



*Coal Section & Bed Sections From Mouth of Leatherwood Creek
To Top of Flint Ridge Mountain, Breathitt Co.*

The Elkhorn District.—This District includes Floyd, Knott, Pike and Letcher counties. No commercial mines are in operation with-



Elkhorn District;
which they are based shall be studied in greater detail.

in its limits at present, but operations on a large scale are projected for the near future. It is confidently expected that at an early day this District will be one of the most important producers—in some respects the most important coke producer—in the State. Its development is delayed by the fact that a railroad must be built before any considerable work in a mining way can be undertaken. The accompanying General Section,* condensed from the report of Mr. A. R. Crandall on the Pound Gap region, will serve as a guide to the coals of the District.† The name "Elkhorn" has been given to this District in recognition of the most notable coal in it, the great excellence of which for coking purposes is now pretty well known, and upon the development of which the future of the region will largely depend. The accompanying Section of the measures in the region embraced in the counties of Clay, Leslie, Perry and (in part) Breathitt county, compiled from data given in Mr. J. M. Hodge's report on the geology of the upper Kentucky river, will aid in prospecting a wide territory.‡ It should be borne in mind, however, that these sections are given only as guides, and that they are largely "preliminary" in nature, subject to revision as the regions covered by the reports upon

*Scale, 300 feet to one inch.

†Given in Chapter XV. of this report.

‡Mr. Hodge's report is reprinted in Chapter XV. of this report.

The Southeastern District.—This District includes the counties of Clay, Bell, Knox, Laurel, Pulaski, Rockcastle and Whitley, in

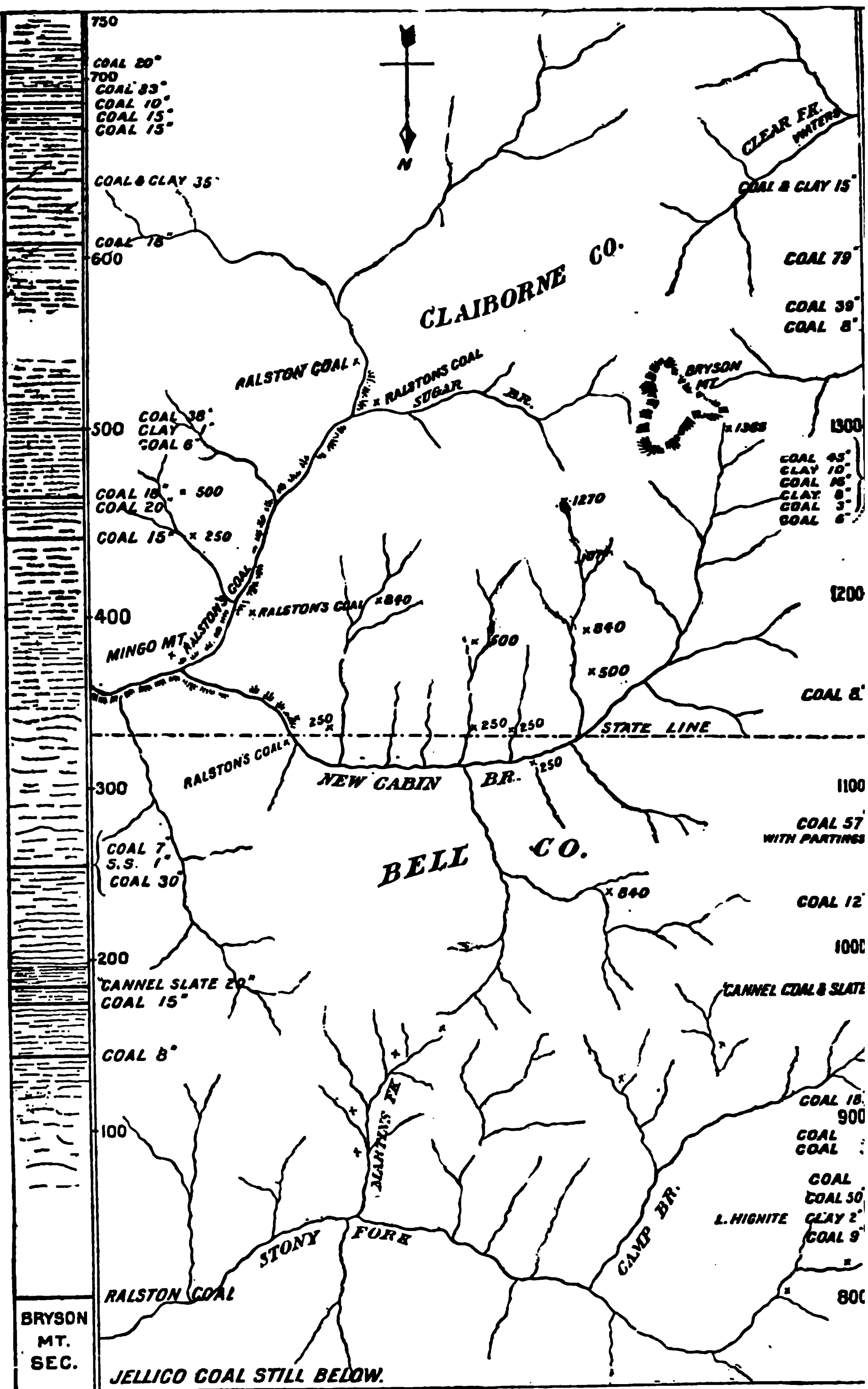
which commercial mines are operated, and the counties of Clinton, Harlan, Jackson, Leslie, Owsley, Perry and Wayne.

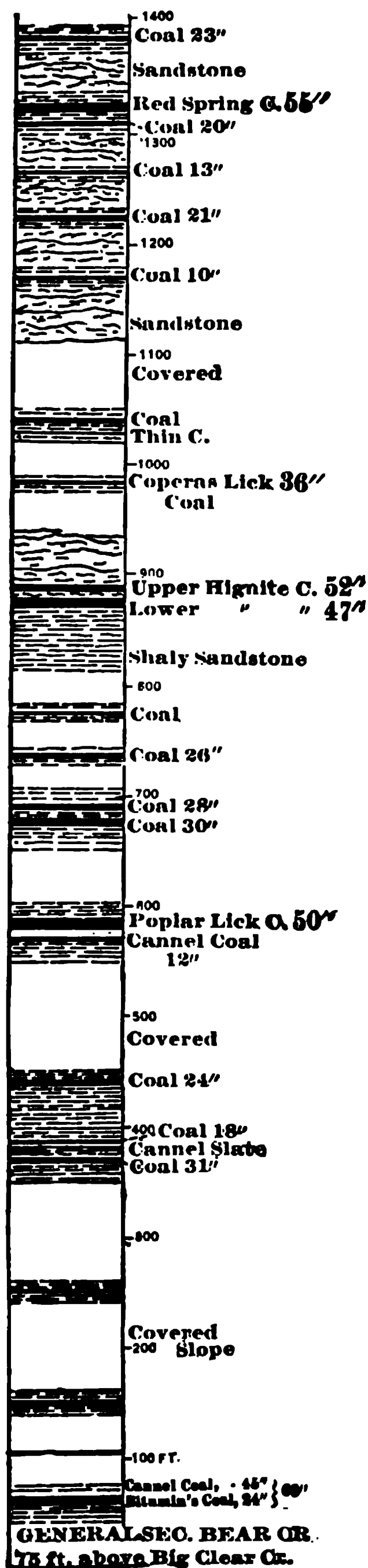
Bell county is wonderfully rich in coals, especially in the region included between the Pine and Cumberland mountains. Prof. Crandall has kindly favored me with a copy of his Bryson Mountain Section, which covers the southerly portion of Bell.* The section is given with a page-map, showing the location of the principal coal openings. The section begins with the "Ralston Coal," which occupies a horizon about 350 to 400 feet above the "Jellico" seam, and it does not, therefore, include the lower coals that outcrop in the vicinity of Middlesborough. In a letter accompanying the section, Prof. Crandall says: "The Ralston coal does not occur as a workable bed in the Clear Creek region, or, in fact, anywhere except on Bennett's Fork and south-

No.		Genl. Sec.	Clay County	Breathitt County	Leslie County	Perry County
	?	Iron Ore			-----	
		60			60	
	24-46				?	
		40-70			40-70	
	25-84				25-84	
		80-200			80-200	
10	8-58		Bell 48"		8-58	
		40-130	125		70-130	40
	9-14-61		Bell 21"		14-61	
		50-75			65	55
8	1-41		39"	41"	1-38	40"
		45-50			50	
7	17-55		55"	5"	17-35	
		40-70	40-46			
16	9-52		9-46	24"	8-33	52"
		40	40'			
	?					
		25-60	35'	25-60	6-22	59"
5	6-61		1-3'	6-61		
		40-85	40-95	40-50		16"
46	4-19		1-17"	19"	4-17	
		40-80	40-80		40-46	55
4	2-50		8-34	9-45	2-50	35-45
		15-35	10-35	15-25	15-35	10-20
4	2-76		19-51	18-45	45-75	28-36
		60-85	85-130	40-85	10-90	
30	4-30		6-16	4-16	8-30	
		45-70	20-65	45-70	35	
3	1-70		1-70	17-36	18-59	21"
		30-125	Knox 95-125	30-65		
2	6-44		1-41	6-18	32	21-44
		55-60	55-60			
15	30-47		30-47			52"
		35-90	45-90	30-35		
1	1-42		1-42	2-30		

UPPER KY. RIVER REGION.

*First published in Report of this Office of 1893.





ward. The sandstone-parting coal is, perhaps, the best datum level. It is from 200 to 250 feet above the Ralston coal, and is at the base of the Little Clear Creek Section 175 to 200 feet below the Poplar Lick coal, and 450 to 500 feet below the Lower Hignite coal. The double bed of coal near the mouth of Bennett's Fork probably represents the Jellico coal—350 to 400 feet below the Ralston seam. On the Clear Fork waters, south of Bryson Mountain, this coal is more typical in character, rising above the mouth of Valley Creek, and increasing in thickness southward, about 400 feet below the Ralston seam, which is readily identified all along the south spurs from Bryson Mountain. In comparing the sections—Clear Creek and Bryson Mountain—I should call your attention to another point: The Poplar Lick coal of the former is a thin bed in the latter section, and the thin bed 30 to 40 feet higher becomes the prominent seam in all the region to the left of Stony Fork as you go up the creek. I have called this bed, which is an excellent coal four feet or more thick, with slight or no parting, the Bryson Mountain seam. It is the Little Coal Gap coal, at the head of Bennett's Fork. This coal, the Ralston and the Lower Hignite, are *the* coals of Bryson Mountain, though others are locally as good, perhaps. I had not quite completed the work of tracing these beds up the Cumberland Valley into Harlan.

One more season's work would have carried the thorough development of the Log Mountain beds of Bell to the head of the river, where local changes obscure the section as now known." During the past year (1902) the U. S. Geological Survey, in co-operation with the Kentucky State Geological Department, has been carrying on geologic work in Bell and Harlan in great detail. It is believed that the problems relating to the coals of the region have been satisfactorily solved. The report will probably be issued within twelve months.

A section of the measures in the Bear Creek region of the Log Mountains, south of the Pine Mountain fault, from a special report by Mr. Crandall to the Log Mountain Coal, Coke & Timber Company, is presented by permission of that company, through the courtesy of its President, Mr. F. A. Hull. The coal worked by that company is the cannel bed seen at the base of the section; but the positions of the cannel and bituminous benches, in the section as drawn, are reversed from their proper order. Following is a bed-section of the deposit, as seen near the ventilating furnace in the mine:

	Inches.
a. Cannel	7
b. Bituminous	9½
c. Hard clay shale	18
d. Bituminous	17
e. Cannel	46
	<hr/>
	97

The portion (a. and b.) above the clay shale (c.) is usually not so distinctly divided. Usually there is a single block of bituminous above the clay, frequently cannel-like either at top or at bottom; the whole, however, usually being bituminous nearly if not quite throughout its thickness. The bottom bench of cannel is in some places as low as 30 inches, and in others it reaches 55 inches. As a rule the thick coal holds up wonderfully well. Following is an analysis of the cannel, made in the laboratory of the Geological Survey by the late Dr. Robert Peter:

Molsture	1.00
Volatile combustible matter	51.60
Fixed carbon	40.40
Ash	7.00
<hr/>	
Sulphur	0.739

It may be well at this place to present the following analyses (by Peter), of some of the other coals shown in the Bear Creek and the Bryson Mountain Sections, and of cokes made from them.

Analyses of the Coals:

	Poplar Lick.	Upper Hignite.	Lower Hignite.	Red Spring Lower Bench.
Molsture	1.80	2.00	2.66	2.60
Vol. Comb.	33.00	32.80	34.14	33.20
Fixed carbon	60.10	59.50	59.70	60.20
Ash	5.10	5.70	3.50	4.00
<hr/>				
Sulphur	0.656	0.986	0.840	0.670

Analyses of Cokes:

	Poplar Lick.	Upper Hignite.	Lower Hignite.	Red Spring.
Volatile, etc.	1.03	0.70	0.39	0.34
Fixed carbon	90.97	87.58	92.61	91.16
Ash	8.00	11.62	7.00	8.50
<hr/>				
Sulphur	0.693	0.909	0.530	0.416

The coke was made at the Pineville ovens, from samples collected by G. M. Sullivan.

775 DEAN COAL

725 COAL

675 COAL

SHALY SANDSTONE

600 COAL

555 COAL

SANDSTONE

445 COAL

SHALE

325 COAL 200' ABOVE
PINEVILLE COAL

265 COAL

235 COAL

200 COAL

SHALE WITH
LIMESTONE CONCRETIONS

125 PINEVILLE COAL

60 COAL

SHALY SANDSTONE

BED OF STRAIGHT CR.
1 MI. ABOVE PINEVILLE

1300 SANDSTONE

COVERED SLOPE

1185 SHALE
FOSSIL LIMESTONE
1175 COAL

1115

1075 SHALY SANDSTONE

1035 COAL 250' ABOVE DEAN COAL

SHALY SANDSTONE

930

895 SHALE

850 MCGUIRE COAL

800

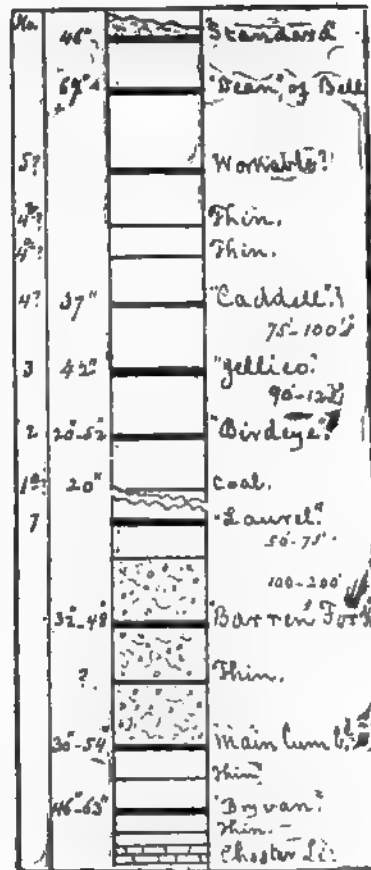
GENERAL SECTION
OF
PINEVILLE REGION
BY
A.R. CRANDALL.

BY PERMISSION OF
SOUTHERN LAND & IMPROVEMENT
C. J. NORWOOD

Plate III. exhibits the vertical distribution of the coals in the Pineville region, north of Pine Mountain. The section was constructed by Prof. A. R. Crandall to accompany a report made for the Pine Mountain Coal & Iron Co., in 1891, and was first published in the report of this office for 1892, by permission of that company's successor, the Southern Land Improvement Company.

The accompanying condensed section for Whitley and Pulaski counties has been compiled from the sections presented in Prof. Crandall's report on those counties. It is to be remarked, however, that the designation of the first coal below the Jellico as the Birdseye is an error. It is the Blue Gem. The "Birdseye" is simply a phase of one of the benches of the Jellico seam, the other bench being absent. The three sandstones shown below the Laurel Coal are the "Conglomerates" of what Prof. Crandall has termed the "Rockcastle Series."

Following is a General Section of that group, based on one constructed by Mr. G. M. Sullivan for Jackson and Rockcastle counties, which will serve for working purposes in the Southeastern counties traversed by the Knoxville Branch of the L. & N. Railroad, and by the Cincinnati Southern Railroad.



1 inch = 300 ft.
Whitley & Pulaski

SECTION OF CONGLOMERATE SERIES.

	Feet	Inches
1. Space. Conglomerate Sandstone in upper part; Shaly Sandstone below	50	
2. Coal		12
3. Principally sandy shale 40 to	25	
4. Shale with Conglomerate Sandstone about the middle 50 to	60	
5. Coal 27 inches to		30
6. Space 50 to	75	
7. Coal 20 inches to		36
8. Space 25 to	30	
9. Coal 10 inches to		61
10. Space 10 to	20	
11. Coal 8 inches to		10
12. Space	15	
13. Coal		15
14. Space	15	
15. Cannel—"thin" coal in Pulaski Section		33
16. Principally Subcarboniferous (Chester) Shales	15	
17. St. Louis Limestone	15	

The qualities and thicknesses of the principal coal beds of this great field have been so thoroughly discussed in the reports of the State Geological Survey, in special reports made for and published by various private associations, and in other publications, that it is not deemed necessary to offer here much more than the general statement and sections that have been given. In this report (chapter xv) are reprinted the three reports of the State Geological Survey on the Eastern Field which are now of most importance. Reports on the northeastern part of the field are still available for distribution, and may be had upon application to the Curator of the State Geological Department.

THE IRON ORES.

There are four special and persistent iron ore horizons in the State, namely:

- 1. In the lower part of the Coal Measures, both in the Eastern and in the Western field, where stratified carbonates and limonites occur at several regular levels. The ores of the Ashland portion of

the Hanging Rock iron region, in Greenup, Carter, Boyd and Lawrence counties, occur here. The limonites of this district run from 33.50 to 46.22 per cent. of metallic iron, and the carbonates yield from 29.73 to 34.42 per cent. The excellent quality of the iron made from the ores is so well known as to need no comment. In the Western field, lying partly in Edmonson, Grayson, Butler, Hart and Muhlenberg counties, is a region wonderfully rich in ores of this period. In Ohio county, also, there are some important deposits. In the Nolin river district (within the first four counties just named), in addition to considerable local deposits, one of which yields 53 per cent. of metallic iron, there are three special ore horizons. The lower one holds from eight inches to two feet of ore, which runs from 22.9 to 35.5 per cent. of iron, and the upper bed ranges from two to six feet in thickness, and yields from 34.4 to 46.1 per cent. of metallic iron. For general purposes, the composition of the ores of these regions may be stated thus: Metallic iron, 33 to 49 per cent.; silica, 11 to 30 per cent.; phosphorus, 0.2 to 1.5 per cent.

2. On top of the St. Louis member of the Lower Carboniferous limestone, both in the Eastern and in the Western field, and in the Southern part of the State, occurs a brown hematite of notable excellence. It is the ore from which the celebrated "Red river car-wheel iron" has been made, in the Red River region of Estill, Powell and Menefee counties—also showing in Wolfe, Lee and Bath; and from which the equally celebrated "boiler-plate iron," of the Cumberland River district, including parts of Trigg, Lyon, Caldwell and Livingston counties, was made. The ore also occurs in the Nolin district, and in a number of the western counties (including Crittenden, Christian, Hart, etc.), in which the upper St. Louis is well developed. It has also been found in the southeastern part of the State along Pine Mountain. The ore ranges from one foot to several feet in thickness, and yields an average of 45 per cent. of metallic iron. Analyses showing as high as 55 per cent. of iron have been obtained. When transportation shall have been so cheapened that the high-grade ores of the great lake regions may be brought

for mixing with these ores in the Cumberland river district, that region will again become one of the noted iron-making districts of the Union.

3. Ore of the Oriskany period, yielding 47.77 per cent. of metallic iron, is brought to the surface along the northern front of Pine Mountain, in Bell and other southeastern counties. Little has been done with it beyond proving its presence as a thick deposit, quite persistent along the line of the mountain. Mr. Wm. Linney has referred the well-known "Preston" or "Slate Creek" ore of Bath county, hitherto regarded as "Clinton," to this horizon in part, and in part to the Corniferous. A description of the ore with analyses, may be found in Linney's report on Bath and Fleming counties.* "It has been seen in Casey county, near Concord Church; near Moreland, in Lincoln; near Brumfield Station, in Boyle; the Indian Old Fields, in Clark, and at several places in Montgomery. Increasing in quantity from west to east, it culminates in Blockhouse and Howard's hills in Bath, and is to be seen but little farther east." (Linney, *op. cit.*, p. 25.)

4. Ore of the Clinton epoch, the equivalent of the oolitic "dye-stone ore," which extends along the eastern face of the Alleghenies from New York to Alabama, is found in Bath, Montgomery and Fleming counties. In Bath county it attains a thickness of nearly three feet, and is a valuable deposit underlying a large area. Contents of metallic iron, etc., in six analyses, range thus:

	1	2	3	4	5	6
Metallic iron	33.34	36.00	40.99	31.00	29.85	38.60
Lime carbonate	16.56	13.08	15.16	55.10	20.50	16.50
Silica	7.16	7.80	6.96	5.00	5.00	5.50
Phosphorus	0.52	0.49	0.44	0.69	0.47	0.75

Two other analyses show iron contents 51.6 and 52.7, with phosphorous 0.40 and 0.41. There is reason to believe that this ore may be reached by drifting at the northern base of Pine Mountain, a fact to which attention was called by Prof. Shaler and the present writer in 1875. Within the last year (1902) it has been found in drilling for oil in Whitley county, at 150 feet below the Devonian

*Ky. Geo. Sur., J. R. P., Dir., 1886.

Black Shale, showing a thickness of 2 feet. This fact is of value chiefly in that it demonstrates the persistence of the deposit over a great distance—from Pike county southwestwardly. The ore was found in the well at a depth of 1,790 feet.

FLUORSPAR, BARYTA, ZINC AND LEAD.

Fluorspar. Remarkable deposits of fluorspar, the great value of which mineral for metallurgical purposes and for glass-making is receiving renewed attention, occur in Caldwell, Crittenden and Livingston counties. Galena and zinc occur with the spar, sometimes in such quantity as to constitute a rather rich ore. Occasionally notable pockets of galena are found. The deposits have, therefore, usually been described as lead veins, and in the earlier days all mining was done for lead. Operations of recent years, however, have been based principally on the zinc contents, and have resulted in developing a considerable mining industry in the counties named, mining being carried on for both fluorspar and zinc, the galena being rather in the nature of a by-product. One of the most notable deposits of zinc carbonate in the country has been opened by Messrs. Blue & Nunn, in Crittenden county.

As was pointed out in my report of a preliminary reconnoissance in the counties mentioned,* the deposits of spar occur in fissures following lines of deep fracture in the Lower Carboniferous beds, the lines usually being marked by faults, the throw of which in some cases amounts to perhaps 1,000 feet.† In some instances the spar occupies a fissure where no faulting, or practically none, has occurred. When the report mentioned was written, it was supposed from the imperfect examinations that could at the time of the reconnoissance be made, that the principal deposit at the Columbia Mines, Crittenden county, was an excep-

*Ky. Geo. Sur., N. S. S., Dir., vol. 1, pt. 7: "Reconnoissance in the Lead Region of Livingston, Crittenden and Caldwell Counties," 1875.

†In a manuscript report on Livingston county, Dr. R. H. Loughridge notes a throw amounting to about that much at McGuire's Bluff. In his published report on "Jackson's Purchase," (vol. F, Ky., Geo. Sur., J. R. P., Dir.), he also notes a fault of over 1,300 feet at Paducah.

tion to the general rule.* Later observations (in 1881) removed that impression. The deposits there also occur as fissure veins.

The walls of the fissures are at the surface sometimes of Chester age on both sides; sometimes Chester on one side and St. Louis on the other; again, St. Louis limestone on both sides. Frequently the rock on one side of a spar-bearing fissure is a quartzose sandstone of Chester age, having the appearance of being tilted at a very high angle or nearly vertical—having a dike-like appearance—while the other wall consists of nearly horizontal beds of St. Louis limestone. In the discussion of this quartzose sandstone in my report for 1895, it was insisted that, while there were doubtless examples of “sheeting” in the region, the vertical appearance of the rock was not, as a rule, due to sheeting, but that the vertical masses represented the upturned ends of the Chester sandstone. The more extended and detailed observations of Mr. E. O. Ulrich and Dr. W. S. Tangier Smith, of the U. S. Geological Survey, have shown, however, that the vertical masses are due to shearing.†

The veins are often much brecciated—dragged-in material being a frequent occurrence—and they are quite irregular in structure as they descend, so far as our knowledge extends. Here it is proper that another impression, received during the hurried reconnoissance mentioned, should be corrected. It was suggested that bedded veins or segregations of ore at the top, or near the top, of the St. Louis were dragged into the fissures, to be subsequently re-arranged by solvents. Later examinations have shown that the suggestion was ill-founded. But I am still strongly impressed with the belief that the minerals were derived from the St. Louis beds. An extended discussion of these deposits will not be undertaken here,

*The examination upon which that report was based were made in the winter season, at a time of unusually severe weather, marked by a remarkably heavy sleet and some snow, and within about two weeks. At the time, it was expected that a more systematic study of the district would soon be taken up, but various circumstances intervened to prevent my doing so. Since the report was written, however, a large volume of additional information has been gathered from time to time, which has resulted in the modification of some of the views expressed therein. A full discussion of the interesting region awaits the proper occasion and the proper medium.

†See Preliminary Report on Lead, Zinc, and Fluorspar Deposits, in Chapter XIII., “Co-operative Geologic Surveys,” this report.

however, since the region has so recently been thoroughly studied by the U. S. Geological Survey, in co-operation with the State Geological Department, and a final report may be expected within a comparatively short time. It is believed, however, that the following conclusions, in chief part repeated from the discussion of the subject in my 1895 report, will prove to be fairly well founded. So far as they have yet been exploited, these veins give little promise of becoming valuable on account of lead alone. It is true that in some localities the proportion of galena seems to increase somewhat with depth—sufficient to injure the spar, without affording material compensation in the way of lead; while data at hand for other localities indicate an increase of zinc contents with depth, rather than of lead; and so it can not be safely said, from present information, that continuous increase of metallic contents of either sort may be counted upon. To the extent that they are now known, and so far as indications go, the veins must be regarded as essentially deposits of fluorspar—of exceptional extent and value—carrying lead and zinc; the lead sometimes being in sufficient quantity to become important as a by-product, and the zinc frequently occurring in such quantity as to constitute an ore upon which may be based a mining operation for the zinc alone. As is well recognized by those operating in the district, there are concentration problems that must be solved before the region can reach that position as a mining center that its possibilities would promise; but it is believed that the solution will in due time be found.* It may be said that there is good reason to believe that the fissures in which the deposits occur do reach considerable depth, that the veins are remarkable in their linear extent, and that in the region under discussion an enormous amount of fluorspar is therefore available for mining. For years practically the entire production of fluorspar in the United States has been limited to the region about Rosiclare, Illinois; and yet the veins in Western Kentucky, which occur in the same geological relations as those

*It is the hope that the mining laboratory of the Department of Mining Engineering, State A. and M. College, will prove useful in that direction.

at Rosiclare, are more numerous, have a greater linear extent, and are more readily traced than those of Illinois, and the spar is of equal excellence with that of Rosiclare.

Fluorspar also occurs at a number of points in Central Kentucky, notably in Fayette and Mercer counties, and there is reason to believe that, although its occurrence is rare as compared with that of barite, there are a greater number of deposits of it in the central part of the State than has hitherto been supposed.

Barytes and Lead. In Henry, Owen, Franklin, Scott, Fayette, Woodford, Lewis, Bath, Lincoln, and a number of other Central Kentucky counties where the Trenton beds are exposed, lead-bearing and zinc-bearing barite occurs in very considerable quantities, filling fissures which doubtless extend down to the Chazy. These veins appear to offer more encouragement as sources of galena than do those of Western Kentucky; there is probably more ground for hope that the lead will increase somewhat in quantity with depth. There are a number of deposits which promise well in galena contents, so far as they have been exploited—notably, at the Gratz mine, in Owen county, and at other points on the same vein in Henry county. The greatest depth to which any vein has been followed is at the Gratz mine, where a depth of about 300 feet has been reached. From a specimen of limestone brought to me, said to have come from near the bottom of the Gratz shaft, it would seem that the latter has penetrated the Bird's-eye Limestone. If this be true, it has reached an interesting point. A number of undoubtedly good zinc (sphalerite) "prospects" are also known, notably, near Stamping Ground, in Scott county, and zinc may prove to be the winning ore of the district, when difficulties as to concentration are solved. Considerable quantities of calcite and fluorspar occur in many of the veins, usually associated with the barite, but in some instances constituting the principal gangue minerals (especially, it would seem, where sphalerite is the prevailing metal); and in some instances the percentage of barite seems to decrease with depth, while the percentages of calcite and fluorite increase. It

should be said, however, that the district has not been closely studied or in any sense well prospected, either for lead or zinc. The barite, the consumption of which is increasing, may prove to be of much value. The better grades of barite are to some extent used alone for making pigment, but usually for mixing with white lead, an addition of from 35 to 50 per cent. of barite being deemed really desirable for some purposes. It is said to detract practically nothing from the quality or covering properties of the paint, but to add to its permanency and render it less susceptible to discoloration by coal smoke and other sulphur-bearing fumes. It is also used as a make-weight in the manufacture of paper, and for coating canvas used in covering meats. Barite, to be classed in the first grade, must be free from quartz and from iron stains. The genesis of our barite veins need not now be discussed, but it may be said that the fissures in which they occur are doubtless not of the same age as those of Western Kentucky; and it may be noted that, just as fluorspar is characteristic of the Lower Carboniferous veins, being the less common mineral in the lower rocks, so is barite characteristic of the Trenton veins, rarely appearing in the higher beds.

MISCELLANEOUS ITEMS.

Even brief descriptions of all the elements of the State's mineral wealth would extend this chapter much beyond the limits deemed proper for it. A few words, however, should yet be said of some of the more important ones that have been but briefly mentioned.

Asphaltum Rock, the principal bed of which forms a member of the Lower Carboniferous series (Chester), occurs in a number of the western counties and in some of the eastern ones. A report on the "asphalt" deposits of the State, by Mr. George H. Eldridge, U. S. Geological Survey, has been published in one of the reports of that Survey. The great excellence of the material for paving streets, flooring cellars, etc., is well

known. There are large areas of the rock in Kentucky, of superior quality. Fine examples of it may be found in Breckenridge, Hardin, Grayson and Logan counties, where it has been quarried for shipment. It also occurs in Carter and perhaps other counties in the eastern part of the State. Occasional deposits of maltha ("mineral tar") also occur, but have not been found in sufficient volume at any one point to prove of economic value.

Fire-clays of proved excellence are found in Carter, Madison and other counties in the Eastern coal-field, particularly along the margins of the Lower Carboniferous outcrops. Also in Ohio and other counties in the Western field, and associated with the upper members of the Lower Carboniferous in various parts of that section of the State. They are especially abundant in the more recent formations of the counties west of the Tennessee river. Concerning the Carter county clay, which is already widely used, Mr. K. B. Grahn, a manufacturer of fire-brick, says: "The Ohio fire-brick, which ranks so highly in Chicago, Pittsburg and the South—wherever the best and most refractory article is used—owes its excellence to no other circumstance than to the Kentucky flint clay, without which it could not be made." Several formations afford an abundance of flint for mixing with clays that lack only a quantum of silica to bring them to a point of great excellence.* Some of the most widely-known fire-brick establishments are those in Carter county.

Pottery-clays for ordinary purposes abound in the State. It is in the Purchase district, however, that pottery clays of especial merit are to be found. Dr. Karl Langenbeck, formerly of the "Decorative Art," etc., factory, Cincinnati, has pronounced the unrefractory clays of this region to be "equal to the finest in England." Of the clay from which some of the samples of ware now on exhibition in the State Geological Museum were made, by the Rookwood Pottery, Cincinnati, Dr. Langenbeck says: "With the addition of some flint (it) makes a very beautiful ivory-ware, almost exactly resembling that made by the celebrated firm of

*See "Comparative Views of the Composition of the Soils, Limestones, Clays, Etc.," by Dr. R. Peter; and other chemical reports of Ky. Geo. Survey.

Copeland & Sons, in England, for table and toilet sets." Dr. R. H. Loughridge, in his report on the "Purchase," says a number of these clays "compare favorably with the German glass-pot clays, which are so celebrated for their great refractory character."

The Petroleum regions best known are embraced in the counties of Adair, Allen, Clinton, Knox, Bath, Estill, Morgan, Knott, Floyd, Wayne, Barren and Cumberland, but there are a number of other counties in which prospecting is in progress and which hold out hopeful promises. While it may here receive no more than a very brief notice, it may be said that there is reason to believe that the shipment of petroleum will eventually become one of the most important industries of the State. Although operations have, in some fashion, been carried on in the south-central oil district for many years, comparatively small results were accomplished because of lack of transportation ways. Within late years, however, the quest for oil areas has been prosecuted with vigor, and with good results. Our petroleum is derived from several horizons, namely: From sandstones near the base of the Coal Measures; from the Waverly (two horizons here); the Clinton; the Upper, Middle, and Lower Hudson; and, possibly, some of it from the upper part of the Trenton. Pipe lines are now under construction which will give all the fields so far opened the needed transportation.

Structural Stones in great variety occur in every section of the State. In the Lower Silurian series are gray, buff and cream-colored marbles admirably suited for structural and sculptural purposes. The Clay monument, at Lexington, is an example of their suitability for such class of work. The colonnade fronting the "old" Capitol is another example of the "Kentucky marble." The building itself is a specimen of the "Birdseye marble" from the same series. The "Cumberland Sandstone," of the Upper Hudson group, when well developed, in many respects resembles the celebrated Buena Vista stone of Ohio, and may be found over a large territory. Towards the base of the Lower Carboniferous (in the same series. The "Cumberland sandstone," of the Upper Hudson

Waverly series) occurs one of the most valuable sandstones, for structural purposes, to be found in this country. It is quarried in a number of places, but most largely in Rowan county, and is well and widely known as the "Rowan county stone." The St. Louis group of the Lower Carboniferous affords limestones of unsurpassed excellence for all structural purposes, and includes a lithographic stone, which in the case of two deposits has been found fit for high-class work. This group is especially well developed in Western Kentucky, the product of the quarries about Bowling Green, Hopkinsville, Russellville and Princeton being well known in Southern and Western markets. In the upper part of the series occurs a beautiful oolite, equivalent in age to the Bedford, Indiana, stone. It is now quarried principally at Bowling Green, though well developed in a number of the western counties. Unlike the Bedford stone, which darkens, the Bowling Green stone bleaches and remains comparatively white when used for structural purposes.

Mr. W. C. Day pays especial tribute to its merits in "Mineral Resources" for 1894. He says: "The product of Warren is deserving of special notice because of its peculiarities and its value as a building stone. This stone is known commercially as Bowling Green oolite. . . . It is quite similar to the Portland oolite of Ireland. The following analyses of Bowling Green and Portland oolite show the similarity between the two:

	Bowling Green. Per cent.	Portland. Per cent.
Carbonate of lime	95.31	95.16
Carbonate of magnesia	1.12	1.20
Silica	1.42	1.20
Water and loss	1.76	1.94
Iron and alumina	0.39	0.50
	<hr/> 100.00	<hr/> 100.00

. . . The stone is soft and easily worked, and, like the Indiana stone, hardens on exposure to the atmosphere. Carvings made upon the stone stand exposure to the air very well. Its color, under the influence of sunlight, tends to become continually lighter.

Its crushing strength is such as to enable it to resist a pressure of 3,000 pounds to the square inch. When heated to redness on the surface and plunged into cold water it revealed no crack, even upon examination with a magnifying glass, and in some cases on being reheated for a second and third time and plunged into water still failed to present indications of cracking. According to present indications the extended application of the stone in the northern and eastern portions of the country seems highly probable." (U. S. Geo. Sur., 16th An. Rep., 1894-'95, pt. IV., "Mineral Resources.")

I feel confident that in counties west of Warren, examples are to be found in the oolite beds equally as good as the Bowling Green stone. Handsome examples of the Lower Carboniferous limestones are also to be found on the Rockcastle and Cumberland rivers, in the southeastern part of the State. A sandstone which occurs in the upper part of the Lower Carboniferous (the "Big Clifty Sandstone" of Western Kentucky), and several of the sandstones of the Coal Measures, are frequently quite good for bridge piers and foundations. One of the handsomest building stones in the State is derived from the "Conglomerate" at the base of the Coal Measures. It is finely developed at Hawesville, Hancock county. Very many of the limestones take a handsome and durable polish. In Rowan a beautiful yellow "marble" occurs, and in Rockcastle is a handsome pink and grey mottled "marble."

Commercial Onyx. Deposits of this material may be found in Green, Adair, Barren, Hart, Christian and a number of other counties. It is usually rather soft, but examples are found that would serve well for interior finishings.

XIII.**LEAD, ZINC AND FLUORSPAR.****Preliminary Report on Lead, Zinc and Fluorspar Deposits of
Caldwell, Crittenden and Livingston Counties.**

This report, by Mr. E. O. Ulrich and Dr. W. S. Tangier Smith, on the work undertaken co-operatively by the U. S. Geological Survey and the State Geological Department of Kentucky, forms part of Bulletin 213, "Contributions to Economic Geology, 1902," issued by the U. S. Geological Survey.

It will be observed that the work was divided, Mr. Ulrich (who was in charge) undertaking the study of the "areal distribution of the geologic formations and the stratigraphic problems connected with the veins and ore deposits," while Dr. Smith attended to "the economic and scientific aspects of the veins themselves." In this preliminary statement, therefore, Mr. Ulrich reports on "Geology and General Relations," and Dr. Smith reports on "The Veins and Vein Minerals."—C. J. N.

GEOLOGY AND GENERAL RELATIONS.

BY E. O. ULRICH.

Introduction.—During the summer and fall of 1902 a party consisting of the writer and Dr. W. S. Tangier Smith, with two field assistants, Messrs. A. F. Crider and F. Julius Fohs, was engaged in an extended investigation of the zinc, lead and other valuable mineral deposits in Western Kentucky and, in less detail, of those occurring on the northern side of the Ohio river in Pope and Hardin counties, Illinois. The latter counties, together with the

counties of Crittenden, Livingston, Caldwell and adjacent portions of Christian, Trigg and Lyon, in Kentucky, are embraced in a lead and zinc district differing in several respects from the other lead and zinc districts of the Mississippi Valley. This district differs from the others in the presence of basic igneous dikes, in the ores occurring principally along fault lines in true fissure veins, and, finally, in having the lead and zinc ores almost invariably associated with fluorite, the latter as a rule forming the most abundant gangue mineral.

The recent work in Western Kentucky consisted largely in the verification and correction of the mostly unpublished results of a study of the geology of the three counties of Caldwell, Crittenden and Livingston carried on by the writer in 1889 and 1890, while a member of the geological survey of Kentucky. The developments of the past decade permitted us to add many new observations and to advance the geologic knowledge of the district to a point where it is possible to describe the ore deposits and the systems of fractures and faults in and along which they occur as well as the geologic formations and their geographic distribution in considerable detail. The following brief statement, however, is to be viewed merely as an advance publication of results and conclusions that will be more fully described, and will be illustrated in a report now in preparation.

History.—The ore deposits of this district have been known to settlers since early in the last century. The first attempt to mine them was made by a company headed by President Andrew Jackson. The operations of this company were carried on in Crittenden county, Ky., their shaft being sunk on the Eureka vein within 100 yards of the present main shaft of the Columbia mine. Between that time and the beginning of the Civil War other equally primitive attempts were made to mine the ore deposits, most of them in Livingston county, notably at the Royal mines near Smithland.

With the general resumption of mining activities in the seventies, and especially in the later years of that decade, when some

excitement was evoked by the successful operations at Rosiclair, on the Illinois side of the Ohio river, work was resumed at several of the mines in Western Kentucky. Considerable activity, indeed, was shown in the development of the Columbia mines, in Crittenden county. In 1878, however, nearly all mining operations in the district ceased, because the market value of lead, which up to that time was the only mineral sought here, dropped to so low a figure that with the lack of transportation facilities mining operations became unprofitable.

The demand for American fluorspar which set in at about this time served to maintain a small degree of interest in mining in the southern portion of the district, but only for a few years, when the same lack of cheap transportation and a slight drop in the value of the product, rendered the otherwise equally good Kentucky mines incapable of competing with the more fortunately situated Rosiclair mines.

In the past five or six years interest in the district has again revived, and, for the first time in its history, the numerous veins and mines are being systematically prospected and developed.

Production.—It is impossible now to make any satisfactory statement concerning the output of the mines of the district prior to 1899, but it doubtless amounted to a thousand or more tons of lead and many times that amount of fluorspar. Estimates of the production of the Illinois mines were not secured, but those in Kentucky produced, according to statements of shippers, about as follows: Fluorspar, 1899, about 5,000 tons; 1900, 10,500 tons; 1901, 13,700 tons, and the first seven months of 1902, 12,000 tons. Zinc carbonate, 1901, 1,136 tons; first seven months of 1902, about 2,450 tons. The production of lead was insignificant, chiefly because the mines in which galena is an important or predominating ore have only recently resumed operations or are awaiting improved transportation. The present year, however, promises to see a notable increase in the production not only of lead but also of zinc, and a smaller increase in the output of fluorspar.

Prospective development.—The mining operations so far carried

on in the district can not be considered as a satisfactory test of its possibilities. It seems probable, however, that a field containing mines that at various times were operated with profit for the lead ore alone, the zinc ores and fluorspar being left on the dump, should under economic and competent modern management become a producer of some importance. Two obstacles stand in the way at present. The first is a lack of a cheap and thorough method of separating the fine-grained sphalerite from the fluorspar with which it is almost invariably associated. Now that the need of such a process is emphasized, it is possible that a satisfactory method will be discovered before the second impediment—lack of transportation—can be overcome. Many men are working on the problem and already several promising if not wholly satisfactory processes have been patented. A plant to do this work has just been completed in Paducah and another is being erected in St. Louis, while a third process is being perfected at a plant near Salem, Ky.

The second difficulty in the way of the development of the district is one common to all new fields, namely, a lack of transportation facilities. The roads throughout the district are almost without exception very bad, rendering successful mining, where the wagon haul exceeds 5 miles, impossible. Fully two-thirds of the entire district lies more than that distance from the lines of the Illinois Central Railroad which traverse it. However, two navigable rivers, the Ohio and the Cumberland, are being used in a small way, and this cheap mode of shipment will doubtless exert a considerable influence on the development of the field.

Stratigraphy.—The geologic formations exposed at the surface or penetrated in mining in the area under consideration are all of Carboniferous age, the lowest being the St. Louis limestone of the Mississippian series, while the highest contains the two lower coal beds of the Coal Measures and is confined to the eastern and northern edge of the district. These lower Coal Measures constitute the western border of the Western Kentucky coal basin, which extends into the district from the east and north. As is

proved by outliers, remaining chiefly because they crown blocks thrown down in the faulting of the region, this border once extended much beyond its present limits, the basal Coal Measures perhaps having originally covered the whole of the area. The base of the Coal Measures or Pennsylvania series is here always formed by a coarse brown sandstone containing more or less abundant quartz pebbles. Immediately beneath this come the sandstones, shales and limestones of the Chester group, the rapidly alternating beds of which have a total thickness of about 600 feet. Next beneath and intervening between the base of the Chester and the top of the St. Louis limestone is the Princeton limestone, 200 to 250 feet thick, which is light-gray and compact and includes more or less shale in its upper third, and more massive, oolitic and light-gray or nearly white in its lower two-thirds. Between these two divisions of the Princeton there is a very persistent layer of calcerous sandstone, varying from 1 to 12 feet in thickness.

The St. Louis limestone underlying the Princeton limestone has a thickness of about 500 feet. Its basal portion is also oolitic, but of a darker color than the Princeton oolites. The remainder consists of dark-gray, highly-siliceous limestone, the silica of which, on the weathering and decomposition of the limestone, to which it is more readily subject than the other limestones, is concentrated into nodular masses of flinty chert varying from 2 to 8 inches in thickness. These rounded lumps often occur in great abundance and are highly characteristic of the formation. Decomposition of the St. Louis limestone is always deep, sometimes extending to a depth of 50 feet beneath the surface, so that the limestone itself is rarely seen except along rapidly eroding streams. Owing to complex faulting the areal distribution of these formations is very irregular and patchy.

Beneath the St. Louis limestone there is an even more siliceous and earthy limestone, representing the Tullahoma formation and Fort Payne chert of the South, the Keokuk and Burlington limestones of Western Illinois, and the Boone chert of Missouri and

Arkansas. This horizon holds most of the zinc and lead deposits of the Joplin district and some of the deposits found in Northern Arkansas. Whether it is ore-bearing in this district or not can only be determined by sinking on the veins to its horizon.

Structure.—The most marked structural feature of the district is an extensive series of fractures, nearly all of which are accompanied by more or less faulting. All available evidence tends to the conclusion that vein deposits of some kind occur in all the fractures where either one or both walls are limestone, excepting where the fractures are occupied by peridotite dikes. These usually are accompanied by only a slight displacement of the strata, and, with a single known, but very notable, exception, are not associated with valuable minerals. It is a fact that nearly all the mines of the district whose value has been proved by development, and nearly all the promising prospects, have either the St. Louis or the Princeton limestone on one or both sides of the fracture. As to the few exceptions where a promising prospect occurs in a Chester area, in every case known to me one of the limestone beds of that group of rocks forms either the hanging or the foot wall of the fissure. We have met with several cases in the district that might appear to be exceptions to this rule, notably the Clements mine on the Crittenden Springs property, and the easternmost shaft of the Tabb mines. Critically examined, however, the exceptions prove to be more apparent than real, since in the first of these cases one of the walls of the adjacent main fault is the Princeton limestone, and in the other the St. Louis limestone, the openings in question being driven in fissures running parallel with and subsidiary to the main faults. These subsidiary fissures were probably formed by large slices of country rock breaking away from the hanging wall, which is usually jointed parallel with the fault plane. If this is true, then the two fissures should unite at some distance beneath the surface.

There are at least 30 faults in the district, with maximum displacements of from 400 to 1,400 feet, and traceable for distances of from 2 to 20 miles or more. Since many of these are connected

with a series of subsidiary fractures and faults, whose displacement rarely exceeds 200 feet, they may be distinguished as the main faults. Of the subsidiary fissures, there are probably hundreds, and it is the belief of the writer that many of them will prove more productive, for equal lengths, than the veins in the main faults.

As a rule the fault lines are practically straight, apparent slight deflections in the course being generally due chiefly to the dip of fault planes, which is usually considerable, upon the line of outcrop over the undulating surface. Occasionally, however, and perhaps oftener than the obscured surface indications now lead us to suspect, the faults are broken up into series arranged *en echelon*. The Tabb fault is a good example of the latter type.

When the displacement of the strata is sufficient to bring two lithologically distinct formations into juxtaposition, as, for instance, when the sandstones of the Coal Measures or Chester are thrown down to the level of the Princeton or St. Louis limestones, there is no difficulty in tracing the fault; but where the displacement is insufficient to produce this result very close stratigraphic comparisons are required to establish its presence. Indeed, the difficulties proved almost insurmountable in the cases where the faults traversed the deeply weathered areas occupied by the St. Louis limestone. In the cases where different members of the Chester formation are on the two opposite sides of the fault plane the difficulties are not so great, since the various members of the Chester formation are usually distinguishable without much trouble, and the line of the fault is very commonly marked by protruding masses of quartzose sandstone.

Taken as a whole, the fractures fall into at least two (and probably four) well-defined systems, one trending northeast, the other northwest. The northeasterly system is the more prominent and its fractures perhaps more generally mineralized than those of the other systems. When platted on a map this system of faults, on the Kentucky side of the river, presents an obscure fan-shaped arrangement, radiating and diverging eastwardly from

the region between Salem and Pinckneyville, in Livingston county. The ribs of the fan pass through Crittenden county, and its successive lines become more and more easterly as we approach the southern boundary of that county and enter Caldwell, where they strike from a little north of east to a few degrees south. It is to be understood that the fan-shaped arrangement of the main fractures of this system has no known genetic relation to the dikes of the district. No igneous rocks are known to occur within 6 miles of the imaginary converging point, while the trend of all the dikes sufficiently known to permit a statement concerning their directions is essentially at right angles to these fractures, being northwest instead of northeast.

A well-defined northwest system of fractures, to which probably all the known dikes of the district belong, finds its best expression in the western half of Crittenden county. Here the trend of the dikes and faults belonging to the system varies between N. 30 degrees W. and N. 37 degrees W. The fractures of this system usually caused only a very limited displacement, but they contain some of the largest mineral deposits of the district, notably at the Eureka, Old Jim and Holly mines.

The northeast faults found in the northern and eastern parts of Livingston seem to indicate a distinct third system, extending across the Ohio from Hardin and Pope counties, Illinois. Similarly, the northwest fractures occurring in the northern parts of Crittenden and Livingston counties, having a direction varying but a few degrees either way from N. 20 degrees W., probably belong to a fourth system, which, like the other, has its strongest development in the Illinois counties mentioned.

The fractures, whether mineralized or not, frequently furnish channels for descending underground waters, as is evidenced by the corrosion of the walls, forming in the case of some of the apparently unmineralized fractures open fissures or crevices filled with red clay. Sink holes are common along some of the fractures, and caverns are known to follow them for short distances.

The formation of the mica-peridotite dikes, of which seven or

eight are known in Crittenden county, and one in Pope county, Illinois, is believed to have taken place prior to the extensive faulting of the region. They were probably produced by an accumulation of molten matter within this portion of the crust of the earth, causing its elevation and fracturing and subsequent intrusion of the igneous masses. The strain on the continuity of the strata produced by their elevation caused the relatively brittle limestone to part along certain lines and form fissures. The more pliable shales and sandstones of the Chester, however, frequently accommodated themselves to the strain, so that the intruded mass failed to pass through them, but spread itself horizontally in sheets between the bedding planes. The fissures occupied by the dikes are generally very nearly vertical and quite straight in their courses, and although narrow, varying from about 2 feet to nearly 25 feet in width, some of them have been traced for miles.

THE VEINS AND VEIN MINERALS.

BY W. S. TANGIER SMITH.

The well-defined veins of this district almost without exception fill fissures due to faulting. They are found in the Princeton, St. Louis, and Chester formations; mainly in the first two. Where two of the formations have been faulted into juxtaposition, veins frequently occur along the fault or in a fissure not far from and parallel to the fault. Veins have been occasionally noted in groups of two or more, either parallel or arranged *en echelon*. Their width is variable; the maximum thus far recorded—in the case of well-defined veins—is nearly 15 feet. Most of the important veins, however, do not exceed 6 or 8 feet in width. The veins all dip at a high angle.

Most of the veins show distinct evidence of movement either in the displacement of the beds on the opposite sides of the fissure or in shearing with or without well-defined slickensiding.

The shearing occurs both in the vein itself—especially near the walls—and in the country rock, where it may extend as much as 50 feet from the veins.

The walls of the veins are usually, though not always, well-defined, and are frequently marked by pronounced slickensiding. One or both walls are often fractured where the vein is in limestone, and are frequently much seamed with minute veins of calcite or fluorite. This seaming also frequently accompanies ordinary fracturing of the limestone where no vein has been formed. The shear planes are sometimes marked by thin, clayey partings, especially in the Chester sandstone. Also, where the veins are adjacent to this formation, dragged-in shales along the walls are not uncommon. These sandstones, where intersected by fissures, whether the latter are filled with vein matter or not, or where they have been filled with igneous rock, have been as a rule silicified, to a greater or less extent, to a hard quartzite. This quartzite, being resistant to erosion, appears in dike-like forms above the surrounding rocks, the shearing giving the effect of vertical or highly inclined bedding.

The principal minerals of the district are galena and its oxidation products; sphalerite ("blende") and its oxidation products smithsonite ("carbonate"), and hydrozincite; pyrite (or marcasite), greenockite, fluorite ("fluorspar"), barite, calcite ("calc spar"), quartz and ankerite. Nearly all of these occur either in the veins or in connection with them. In addition, bitumen is occasionally found in the veins.

Fluorite.—Fluorite is by far the most important of the vein minerals, composing, as a rule, the greater part of the vein, the remainder being made up of a varying proportion of other minerals, with dragged-in country rock. In some cases the vein is composed almost wholly of fluorite; in others the proportion of other substances is so large as to make it unprofitable to work the deposit. The associated minerals and rock fragments may be found throughout the vein, but in general they are most abundant toward the margins. The fluorite veins frequently show a pro-

nounced banding, due either to shearing or to a variation in the grain of the fluorite in bands parallel to the walls of the fissure.

In the Chester sandstone fracturing has frequently resulted in brecciation rather than in a well-defined fissure, and the breccia may be more or less completely cemented with fluorite. Barite may occur under similar conditions, and both are found replacing sandstone to a greater or less extent.

The usual mode of occurrence of fluorite is massive and granular. It is also found as cubic crystals in vugs or coating the walls of small fractures in the country rock; but well crystallized occurrences are comparatively rare. It is generally translucent, though rarely transparent; its color is usually white, sometimes purple, and occasionally yellow.

Calcite and barite.—Of the minerals associated with the fluorite calcite is the most abundant. It occurs as white crystals or coarsely granular masses scattered through the veins. Barite is next in amount, though it is not found in most of the veins. Where it occurs with the fluorite it is apparently intergrown with it. There are also in both the St. Louis and the Princeton limestones veins of fine-grained barite occurring either alone or with a minor proportion of fluorite; but so far, except in one instance, this mineral has not been found in sufficient quantity to pay for mining.

Galena.—Galena occurs in many of the fluorite veins, sometimes in quantities large enough to make it profitable as a by-product, though in most cases it is insignificant in amount. It usually occurs in grains and crystals of varying size, though generally small, disseminated in the fluorite, for the most part near the walls of the veins, and frequently concentrated in lines parallel to the walls. Occasionally it is met in elongated columnar forms, due to shearing in the veins.

Sphalerite.—Fragments of the wall rock, whether quartzite or limestone, are common in most of the veins. They have in some cases been replaced by fluorite to a greater or less extent. Sphalerite, which is found in many of the veins, occurs mainly as minute grains disseminated in the included fragments of limestone, fre-

quently concentrated near the contact between the fragments and the inclosing fluorite. It is also found occasionally disseminated in the fluorite and in the wall rock where this is of limestone. This fine-grained sphalerite is more abundant, on the whole, than the galena, and will prove of economic importance if a satisfactory method of separating it from the associated fluorite is found. Sphalerite is also found here and there (especially in the region southwest of Crittenden Springs) in coarser form and in greater amount.

There are a number of deposits in which sphalerite or its oxidation products have been found apparently unassociated with fluorite, notably in the Old Jim mine, where the ore (smithsonite with some hydrozincite) occurs adjacent to a dike of peridotite. Here, as in other similar instances, however, mining has not been carried deep enough to show the character of the unoxidized ores.

Effects of oxidation.—Above ground-water level the oxidized and carbonated surface waters have removed from the veins much or most of the calcite which they contained, as well as the included fragments of limestone, and have altered the country rock to a greater or less extent, but they have had comparatively little effect as yet on the fluorite and barite. The galena has not been oxidized to any considerable extent, and is still found near the surface. The fine-grained sphalerite has been largely removed from the veins, having been in part altered to smithsonite (zinc carbonate), which in turn is being slowly dissolved and removed by the surface waters. At the Old Jim mine the zinc salts in solution, reacting with limestone, have replaced it here and there with zinc carbonate. The result of the leaching out of the calcite and limestone fragments has been to leave the fluorite in a more or less honeycombed condition. Where it was not originally associated with these substances it is usually found in lumps. Wherever the grains have been loosened or separated it is found in a sandy or gravelly form known as gravel spar. In all these cases it is usually associated with red clay formed as a residual product on the solution of the adjacent limestone.

The depth of oxidation along the course of the veins is variable and may be as much as 100 feet or more. In a few cases fresh, unaltered vein matter and country rock come nearly or quite to the surface. Descending surface waters have occasionally formed channels along a fissure, thus carrying oxidation and oxidized products considerably below the normal level of underground water.

Vertical distribution of vein minerals.—As far as the deposits have been developed it can not be proved that the fluorite, on the whole, actually decreases with depth, though it is said to do so in some cases. This assumed decrease may be merely comparative, since the associated calcite in many instances appears to increase with depth, although it is quite probable that in general this is due merely to the fact that it has been removed by surface waters at the higher levels. Galena, in general, appears to be most abundant near the surface, and on the whole to decrease with depth, though in many instances it is not apparently more abundant at one level than at another. Above the level of underground water fine-grained sphalerite has been generally removed or changed to carbonate. Below this level it seems probable, from what has been observed, that it does not materially increase in amount with depth. The coarser occurrences of the sphalerite may be due to secondary enrichment, the finer-grained mineral having been oxidized and carried downward in solution below ground-water level, where it was redeposited as the coarser-grained sphalerite. Connected with these deposits there appears to have been also some secondary concentration of the galena. No positive statement can be made on this point, as none of the mines yielding coarse sphalerite were accessible below ground-water level at the time the region was visited by the writer; but if this is the true interpretation of the facts these deposits of coarser sphalerite will be found to be most abundant just below ground-water level, and will tend to decrease with depth till only the finer-grained ore is found, the latter representing the primary concentration.

XIV.**THE BIG SANDY VALLEY.**

The following report on the resources of the Big Sandy Valley, by Prof. C. Newton Brown, (of Ohio State University and formerly assistant on the Ohio Geological Survey), is from the report of the Chief of Engineers, U. S. A., touching the improvement of the Big Sandy river, including Levisa and Tug Forks, for navigation. It was reprinted by Hon. G. W. Stone in the excellent report issued by him for 1900, and is reproduced here to meet the demands for it, the supply of copies of the 1900 report having been exhausted for some months.

REPORT OF PROF. C. NEWTON BROWN UPON THE MINERAL WEALTH OF
THE BIG SANDY VALLEY FROM LOUISA TO THE
HEAD OF NAVIGATION.

The two branches of the Big Sandy river coming together at Louisa, Ky., drain an area of about 4,000 square miles lying in the States of Kentucky, West Virginia and Virginia. The Levisa Fork is the western and larger branch and its basin includes about 1,600 square miles in Kentucky and about 800 square miles in Virginia. The Tug Fork is the eastern branch, and forms a part of the boundary line between Kentucky and West Virginia. It drains about 500 square miles in Kentucky, 700 square miles in Virginia and 400 square miles in West Virginia.

These streams are navigated by small steamboats, ranging from 20 to 137 tons burden, during the winter and spring, and by "push boats" during the summer and fall. The boats go to Fish Trap, the mouth of Russell Fork, on the Levisa Fork, or about 100 miles above Louisa. On the Tug Fork they go to the mouth of Sycamore creek, about 4 miles above Williamson, W. Va., and 61 miles above Louisa.

The area drained by these streams and their branches is rough and mountainous, and includes a part of the Cumberland Mountains. The valleys are usually quite narrow, giving very little land adapted to agriculture, and the hills or mountains rise from 200 feet to 1,500 or 1,600 feet above the streams. The area has had a dense growth of hardwood forest, including black walnut, poplar, oak and other valuable and merchantable timber. Most of the timber near the main streams has been removed, but there is yet a very large amount of valuable timber that can be brought to market on these streams and will furnish employment to large numbers of men for many years to come.

The entire drainage basin of the Big Sandy river is included in the great Appalachian coal field, which extends from Pennsylvania to Alabama, and which includes the great coal and iron regions of Pennsylvania, Ohio, West Virginia, Kentucky, Virginia, Tennessee and Alabama.

Some of the minerals of great economic worth peculiar to this great Appalachian Basin are now known and worked in the Big Sandy Valley, and it is probable that others will be discovered in paying quantities as the region under consideration is prospected and developed.

The principal minerals of economic value and importance to be expected and sought for in this region are as follows: Coal, iron ore, clays, building materials, oil and gas, salt, glass sand, etc.

The coal is at present considered to be by far the most important and valuable of the minerals so far found or developed in the Big Sandy Valley, and the bulk of this report is devoted to that mineral. Before taking up the description of the coal field a short statement will be made of each of the other minerals observed in the valley.

IRON ORE.

The iron ores of the Big Sandy Valley have never been prospected or developed, except to a very slight extent, between the Levisa Fork and Tug Fork, near and along the old line of Chat-

taroï roalroad, now a branch of the Chesapeake & Ohio railway. Here a few veins were opened and some ore shipped to the blast furnaces at Ironton, Ohio, and Ashland, Ky. But on account of the thin veins of ore and high freight rates on the railroads this ore could not compete with the great deposits of the Lake Superior region, and also of other parts of the Appalachian Basin, and the mining was therefore stopped at this place.

From direct observation and various reports the following statements can be made in regard to the iron ores of this valley:

Near Torch Light station, and on Griffiths creek to the east of this station, a very nice looking block ore was seen that ranges from 12 to 14 inches thick, and also in the same locality a black band ore, ranging from 18 to 30 inches thick, was seen that had been worked in a small way. Analyses of these ores are given on page 363.

The following analyses of ores from the above-mentioned district are taken from the Geological Survey of Kentucky, Chemical Report, Vol. A, part 3, page 183, 1888:

A. Limonite iron ore, from a bed at See Gap. A dense dark brown ore, coated and mixed with ocherous ore.

B. Iron ore. Yellow kidney. On Straight Creek fork of Three-mile Creek.

C. Iron ore. Limonite, irregularly cellular, with a little ocherous ore. From head of Three-mile Creek.

D. From same place as "C" and the same kind of ore.

E. Iron ore. Part of a nodule of dense limonite, with soft, ocherous material in interior. Wallbridge Station on Chattaroï railroad.

F. Iron ore. Brown limonite ore. Pecks Station. Griffiths Creek.

G. Iron ore. Head of Griffiths Creek. A dense, dark, reddish-brown limonite ore.

H. Iron ore. A very hard oolitic ore. From north of Louisa and not from the same district as the other ores of this list; said to be 3 feet thick.

The following analyses of black band ores from Lawrence county are taken from the Kentucky Geological Survey Chemical Report, Vol. A, page 280:

A. Black band ore, from near Louisa. Bed said to be from 12 to 16 inches thick and underlaid with 15 to 20 inches of bituminous shale.

B. Black band ore, from same locality as sample "A." From the Gavitt farm, on the West Fork of the Big Sandy river. A seam of coal from 4 to 6 feet thick just below it.

C. Average sample of black band ore on Louisa Fork of Big Sandy, 6 miles south of Louisa.

	A	B	C
Iron	33.26	33.92	25.75
Phosphorus .....	.....	.....	.553
Sulphur .....	.483	.....	.354
Lime .....	.....	.....	.924
Magnesia .....	.....	.....	.150
Bituminous matters .....	.....	.....	13.700
Silica	7.460	.....	6.360
Alumina .....	.....	.....	17.920

All of these ores are from Lawrence county, Ky., and are on the waters of the Big Sandy river.

	A.	B.	C.	D.	E.	F.	G.	H.
Iron peroxide.....	45.48	52.47	54.19	63.31	57.08	64.33	54.51	60.79
Alumina	9.53	9.73	17.42	9.44	6.	6.79	15.15	7.77
Lime carbonate.....	Trace	Trace	Trace	Trace	Trace	Trace	14.80	.60
Magnesia carbonate.....	.38	Trace	.45	.08	.16	.15	2.05	.68
Phosphoric acid.....	.64	.64	.51	.38	.51	3.33	.38	.38
Siliceous residue	34.00	23.30	16.	12.40	25.40	9.40	3.80	13.60
Water and loss	9.98	13.86	11.43	14.38	10.90	16.01	9.31	16.18
Per cent. of iron	31.83	36.74	37.93	44.32	39.92	45.03	38.15	42.55
Per cent. of phosphorus ....	.28	.28	.22	.17	.22	.93	.17	.17

On the head of Buffalo creek of Johns creek, in the western edge of Pike county, on the land of Spencer Boyce, an iron ore has been opened, showing 28 inches of a fine looking red ore, soft and easily worked. The ore is about 500 feet above the creek, with about 250 feet of hill over the ore. The analysis is given below.

Also in the same locality, on the lands of J. Harvey Leslie, on Caney branch of Johns creek, Pike county, Ky., and about 3 miles due east of the ore deposit on the Boyce land, another ore deposit had been quite well prospected. The ore is 115 feet above the creek, with several hundred feet of hill above it. The ore is quite irregular in thickness where prospected, ranging from nothing to 4 feet in a few hundred feet. The analysis is given below.

On the land of Jefferson Robinson, on Arkansas or Layne branch of the Left fork of Beaver creek, Floyd county, Ky., about 9 miles due south of Prestonsburg, an iron ore shows in a "rock house" under a thick ledge of sandstone. It is also quite irregular in thickness, showing 3 feet at one place, running some feet 12 and 16 inches thick, and then cutting out in a few feet farther. The analysis is given below.

The following analyses are taken from the Kentucky Geological Survey Reports: "A" and "B" from Chemical Report, Vol. A, part 3, page 188; "C" from Chemical Report, Vol. A, part 3, page 174, and "D" from Chemical Report, Vol. A, part 2, page 232:

A. Iron ore from Buffalo creek.

B. Iron ore from Caney creek.

C. Iron ore from Beaver creek.

D. Iron ore from land of Levi Potter, on Elkhorn creek, Pike county, Ky., 16 miles from mouth of creek, about 150 feet above creek. Occurs in large blocks. See Kentucky Geological Reports, "Report on the Pound Gap Region," page 13.

	A	B	C	D
Iron peroxide	70.42	58.84	55.53	59.63
Alumina	9.54	16.63	10.57	7.93
Lime carbonate .....	.50	1.20	12.10	.....
Magnesia carbonate .....	.23	.61	2.50	.....
Phosphoric acid	1.28	2.18	2.05	.56
Siliceous residue	1.20	4.60	5.	29.73
Water, etc., and loss	16.83	15.96	12.26	2.16
Per cent. of iron	49.30	41.18	38.87	41.74
Per cent. of phosphorus .....	.87	1.49	.89	.23

The Kentucky Geological Survey in its report on the Pound Gap region, page 11, etc., makes the following statements in regard to iron ores on Elkhorn creek and vicinity, in the eastern part of Pike county: "Two regular iron-ore horizons are brought above the drainage by the Pine Mountain uplift; the same that are exposed by the cutting away of the overlying rocks along the front of the Cumberland Mountain. . . . Not much is known of the thickness and persistency of this ore in the Pound Gap region, as it is usually covered by the soil and mingled fragments of rock which cover the face of the mountain to a considerable depth.

"It is seen at many points in a weathered state upon the surface, sometimes, as at the head of Pigeonroost branch and of Toms branch of Elkhorn creek, in a spur of Pine Mountain, it is exposed in great profusion over the surface.

"The quality of the ore is not inferior to that of Estill and Menifee counties. Whether it is thick enough for profitable mining, dipping as it does into the face of the hill, is a question to be settled by practical tests. The surface indications are favorable but could not be held as conclusive, except as to the equivalency and uniform good quality of the ore.

"The Upper Silurian or dyestone ore, may, with reasonable certainty, be assumed to occupy its regular place in the beds at the foot of the mountain. . . . In this region it is everywhere covered by the abutting coal-measure rocks, or by the talus from the ledges of overlying rocks. . . . Along the face of the Cumberland Mountain none of these conditions stand in the way of a study of the ore, which occurs in several beds, or interferes with the ready mining at many points far north and south.

"On Elkhorn creek another ore occurs which does not belong to the Pine Mountain series; but as it is a local deposit along the face of the mountain, it may properly be described in this connection. This bed has the character of a recent deposit, though its occurrence at many points along the valley on both sides of the creek at the same horizon, apparently, and the similarity of the arrangement of the parts of the bed at widely separated exposures, makes it appear like a continuous bed. It is made up of from 1 to 3 feet of anhydrous sesquioxide of iron, including many fragments of sand-rock and siliceous shale, the latter apparently greatly changed by heat. The ore is also in part blistered and porous, as though through the agency of heat. Resting on this there is generally found from 1 to 2 feet of earthy ore, or red ochre, with small fragments of siliceous rock intermingled. In general the lower part includes too great a proportion of siliceous material in the form of fragments of sand-rock to be valuable. In places, as noted near Levi Potter's, it will probably be found to be comparatively free from these objectionable features. (An analysis of this ore is given above as sample D.) It is probable that this ore is a 'rim' deposit, but nothing has been noted which explains its occurrence at this particular horizon; and the appearance of metamorphosis can not be readily explained from the data at hand. . . . The most that can be said for this ore is that it is probable that it may prove valuable as an iron ore locally, and generally as a source of red ochre. It is exposed along the Elkhorn Valley from near the mouth of Sycamore creek, of Elkhorn, toward the head for 6 miles or more. On Pigeonroost

branch of Elkhorn it is 285 feet above the main creek. On Harvey Gibson's land, opposite side of the valley, about the same level, it is relatively lower up the creek, being 150 feet above the main drainage at Levi Potter's."

CLAY.

No attention had been given the clays of this valley beyond an occasional use for ordinary building brick. The stratified clays have not been prospected or sought for as in other parts of the great Appalachian coal basin. A few good samples of a plastic fire clay were seen at two places in the area examined. It is very probable that workable deposits of valuable clays will be found as the country is developed. It is to be expected that clays suitable for the various grades of fire brick and pressed building brick, sewer pipe, and for the manufacture of Portland cement, will be found in the coal-measures exposed in the Big Sandy Valley.

BUILDING MATERIALS.

There is a great abundance of rather coarse-grained sandstone of good quality that will be valuable for the buildings and masonry structures necessary in river improvements, railroads, mine buildings and manufacturing establishments.

Clay for ordinary building brick is found in quantity and quality suitable for all ordinary brick structures.

Limestone was found at only one locality. The Pine Mountain, forming a part of the boundary line between Kentucky and Virginia, and lying between Elkhorn creek and Pound river, branches of Russell Fork of the Levisa Fork, has a bed of fine-grained, solid, non-fossiliferous white limestone, from 200 to 300 feet thick, lying about 1,000 feet above the main stream. This will supply a fine quality of lime to all this region for building and manufacturing purposes as soon as some means of transportation is secured. This limestone, together with some of the clays or clay shales of this region, ought to make a good quality of Portland cement.

OIL AND GAS.

Oil is now being developed in the Big Sandy Valley and paying quantities have been found at several places. The persons doing the work have not completed their investigations, and are therefore not at present making public all the information they have gathered. The drilling is being pushed rapidly at many places, and the natural inference is that the results are satisfactory or the work would not have been continued for over two years, as it has been. On Beaver creek, Floyd county, Ky., about 14 miles nearly due south of Prestonburg, a few wells are now producing oil in paying quantities, and two tanks of about 15,000 gallons each have been erected to store the oil until some means of transportation can be provided.

Gas has been known on the Tug Fork, at and near Warfield, Martin county, Ky., for many years, and within the last two years it has been piped to the towns along the Ohio river. At Warfield the gas is also now used for making a high grade of lampblack.

The oil wells being drilled in Floyd and Pike counties, Ky., also develop considerable gas, although they are located with a view of not striking the gas.

It is quite probable that extensive oil and gas fields will be found in this part of the Big Sandy Valley. While the oil and gas will be transported through pipe lines, and so furnish no direct traffic on the river in this way, the large quantities of supplies, machinery, etc., necessary for drilling and for handling the oil and gas would seek the cheaper water transportation if it were provided.

SALT.

Many years ago salt was manufactured in considerable quantities at several places in this valley, the most important, probably, being at Warfield, Martin county, Ky., where the old works can still be seen.

Many of the oil and gas wells now being drilled throw out large

quantities of salt water that could be utilized for salt making under favorable circumstances. For fuel either the gas or some of the many coals so liberally scattered through this country could be used. It is probable that cheap water transportation would revive some of the old salt works of this valley.

OTHER MINERALS.

It is possible that there are other minerals which may be found in such quality and quantity as should warrant their working in a large way so as to furnish traffic on the river, but not enough is known of them to permit any positive statements being made in regard to them at this time.

The remainder of this report will be devoted to a description of the coals seen on a trip through the country and to a compilation of matter from the Kentucky Geological Survey Reports and other reports treating of this district.

COAL.

The coal of the Big Sandy Valley has attracted much attention from persons engaged in coal mining and business and from persons seeking a fuel suitable for iron manufacture or other special issues.

The Norfolk & Western railroad has opened up that portion of the field along the upper part of the Tug Fork, and the "Thacker" coal and the "Pocahontas" coal and coke have attained a high rank in the markets of the North and Northwest.

The building of the Norfolk & Western railroad along the upper part of the Tug Fork has caused that district to be fairly well prospected, and the coals are now pretty well known along that valley. It has also brought a large number of people into the region who are acquainted with the geology of a coal region and who are quick to notice signs of coal, and who can intelligently note and report any openings that are made into the various coals.

Along the Levisa Fork above Peach Orchard there is no means of shipping coal and no mines of any size. The only openings are those for the local supply, which are usually made near the foot of the hill or mountain in the most convenient place, without regard to what better coals may be found higher in the hill. In many locations the people burn only wood, which is very abundant, and so know nothing of the coals except as they may be accidentally exposed in a landslide, at the roots of an overturned tree, or in a rock house. In a number of places outside capitalists have bought up large tracts of land for the coal, and in such places the lands have been very well prospected, and the large companies usually know pretty well what they own in the way of coal. When the representatives of these companies could be found and consulted much valuable information was obtained, every one placing their notes and maps at my disposal and helping me in every possible way in the collection of information.

In the Big Sandy Valley several varieties of soft or bituminous coal are found in great abundance and fine quality. The principal varieties that carry independent names are splint coal, cannel coal, gas coal, coking coal, steam coal.

Splint coal is usually a rather hard coal that will not break into small pieces when handled or shipped. It has a rather dull appearance and has been sometimes mistaken for an impurity called "bone coal" by persons not acquainted with it. It makes a good coal for domestic use and for locomotives and hand-stoked steam boilers. It ships well and stocks well, two very important properties in a coal that is to go into the general markets.

Cannel coal is used for domestic grate fires and gas making. It mines in large blocks, usually as thick as the full bed of coal. It always commands a very high price in the large city markets. The coal is always found in limited areas called "pockets" or "pools." These "pockets" may have an extent of only a few acres or of several square miles. Two mines are now being worked in this coal in Johnson county, Ky., on the Levisa Fork, and the product bears a good name in the general markets. The coal

from these mines is shipped to points in both New York and Texas.

Steam coal is the name applied to any coal well adapted to use under steam boilers. The same coal may also make a good domestic coal or gas coal. There is usually no objection to small or fine coal for steam making, and in machine-stoked boilers it is desirable. A steam coal must not form clinkers on the grate bars of the fire box or furnace, and should have low percentages of ash and sulphur.

Gas coal is a name applied to any coal that is well suited for making a good quality of illuminating gas. It should have a high percentage of volatile combustible matter and a low percentage of sulphur. The same coal can be, and is, used for many other purposes.

Coking coal is a name applied to bituminous coals with a low percentage of volatile combustible matter and with a high percentage of fixed carbon. A low percentage of ash and sulphur are very desirable. This coal is used for making coke for use as a fuel in blast furnaces and other iron-working furnaces. The same coal may be used for domestic and steam use. It usually mines in small lumps, and is a rather weak coal.

In the valleys of the Tug and Levisa forks the coking coal is mostly found in the eastern portion and the splint and cannel coals in the western portion and northern portion, although exceptions are found to both of these statements. No sharp dividing line can be drawn, and the two or three varieties may be found in the same hill, but the present knowledge of the area indicates the above general distribution. For ease of description the basin of each fork will be taken up separately and then described by counties and creeks.

In order to form some idea of the total possible traffic that the coal of the Big Sandy Valley may furnish to the river when improved and railroads when built, estimates of the total tonnage of coal will be made, but it must be remembered that any statements as to the quantity of coal that may be obtained from any

Particular large area of this valley must of necessity be rough estimates, on account of the lack of accurate data as to the areas and thickness of the various veins.

In making the estimates that will be given hereafter every precaution will be taken to make them conservative and less than the general belief of those persons best able to judge the matter from a thorough acquaintance with the valley. Some of the companies holding large areas of the coal lands have had a few surveys made of the crop lines of the principal veins on their lands and these have been made use of. The topographical contour maps made by the United States Geological Survey were studied on the ground and other notes taken from observations made during an extended tour of the valley.

It will be estimated that 1,000 tons of 2,000 pounds each can be shipped for each foot of thickness from each acre. This is to include the total shipment of coal, including lump, nut, and pea coal. This allows for about 700 tons per foot per acre to be lost in ribs and pillars and in "faults" and "horse backs." In many mines 1,200 tons of lump coal besides the nut and pea coal is shipped from each acre for each foot of thickness of clean coal.

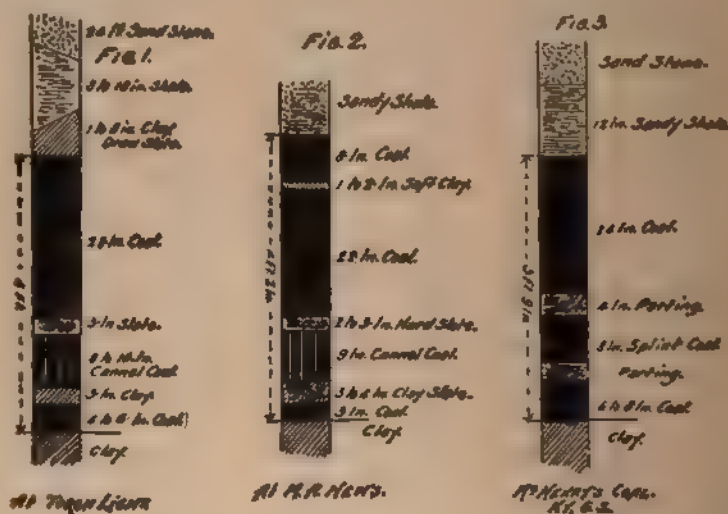
The above assumptions give 640,000 net tons (2,000 pounds) for each foot of thickness for each square mile, and this number will be used in the estimates made below.

LEVISA FORK.

Laurence County, Ky., Torch Light and McHenry's coal.—Going south from Louisa, Ky., at the junction of the Tug and Levisa forks, and up the Levisa Fork, the first coal of workable thickness, so far as known, is found at Torch Light Station, on the Chesapeake & Ohio railroad, about 6 miles from Louisa. There is a small mine working here and shipping coal on the railroad, and it is fitted for shipping on the river. The coal lies about 160 feet above the river, and has from 200 to 400 feet of hill over it. The coal is found on both sides of the river, and also across the ridge

to the west, on the upper part of Lick creek. The coal dips strongly to the north, about 50 to 60 feet per mile, both on the river and Lick creek, and soon goes below drainage. It also seems to thin out to the north, so far as visible.

The coal bed has a thin layer of cannel coal, about 8 to 10 inches, near the bottom of the bed, which is not separated from the bituminous coal when shipped it being left in to increase the value of the coal for domestic use. The coal has a good reputation as a domestic coal, but it is not so well liked as a steam coal.



The Kentucky Geological Survey calls this the McHenry coal, designates it as the No. 3 coal, or the equivalent of the Peach Orchard coal mentioned below. (Vol. C, p. 68, pl. 31.) See figs. 1 and 2 for structure of this coal bed.

The Kentucky Geological Survey, pl. 31, Vol. C, gives the section of the McHenry coal shown in Fig. 3. It is opened in the immediate vicinity of Torch Light. The analysis of the McHenry coal is given in the table below, as sample D.

About 80 feet above the coal shown in Figs. 1, 2 and 3, coal has been opened and is reported as being 6 feet thick, but full of thin

clay partings. The openings have fallen in, so that no measurements could be made at present.

The coal shown in Figs. 1, 2 and 3 is open at several places up the river toward Peach Orchard.

Georges Creek.—This is a large stream coming into the river from the west, between Torch Light and Peach Orchard. Near the hilltops along the lower part of the creek the Peach Orchard coal is reported as having nearly the same thickness as at the Peach Orchard mines, but no openings were seen where measurements could be made.

About Lomansville, on the upper part of the creek and near the county line, between Lawrence and Johnson counties, the No. 1 coal is opened and worked near the creek level. It has here an average thickness of 36 inches and rises in places to nearly 5 feet. There are many places where it can be worked to advantage on this creek. (Kentucky Geological Survey, part 5, vol. 6, second series, p. 12.)

Nats Creek and Peach Orchard.—Just below the mouth of Nats creek, coal was mined and shipped in barges on the river for several years some forty years ago. It was discontinued on account of the great loss of boats on snags and rocks and because there was no water for several months during the summer. In 1881 the Chattaroi railroad was completed to this point and a large mine opened on Nats creek, about 3 miles from the river. It was equipped with all the modern improvements for mining and handling coal, and has been shipping about 55,000 tons of coal per year.

The Peach Orchard coal lies about 200 feet above the river, and the ridges rise about 400 feet above the coal. There is a large area of this coal between the Levisa Fork and Rock Castle creek, covering at least 60 per cent. of the total area between the two streams.

The coal has a good reputation as a domestic and steam coal. Its thickness and structure are shown in Figs. 4 and 5, and the analysis is given in the table below.

A. Peach Orchard coal. From Annual Report of Inspector of Mines of Kentucky for 1895, page 226.

B. Peach Orchard coal. From Kentucky Geological Survey, Vol. C, p. 18.

C. Coke from Peach Orchard coal. From Kentucky Geological Survey, Chemical Report, Vol. A, part 2, p. 205.

D. McHenry coal. From Kentucky Geological Survey, Vol C, p. 18.

	A	B	C	D
Moisture	3.36	3.24	5.10	4.60
Volatile combustible matter	37.05	36.56	.90	35.70
Fixed carbon	52.82	54.95	90.06	53.28
Ash	5.55	5.24	3.94	6.42
Sulphur	1.22	1.19	.82	1.08

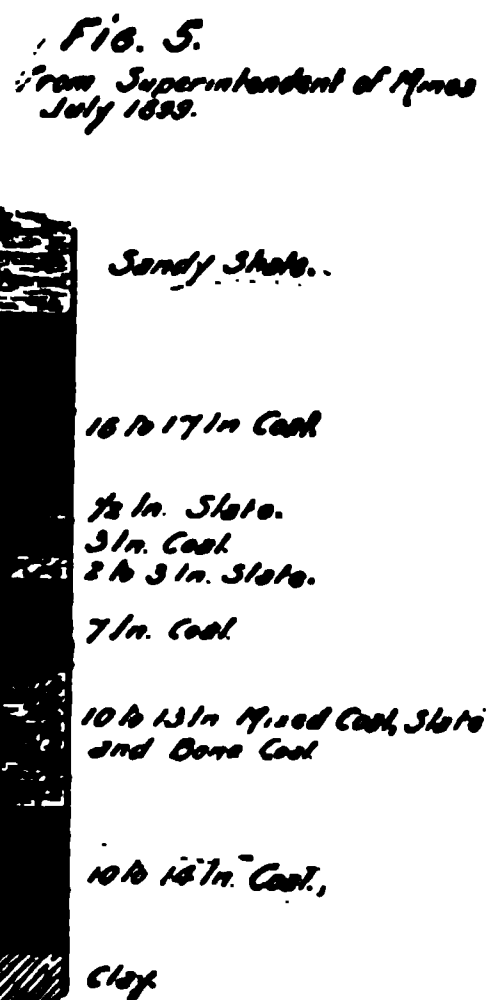
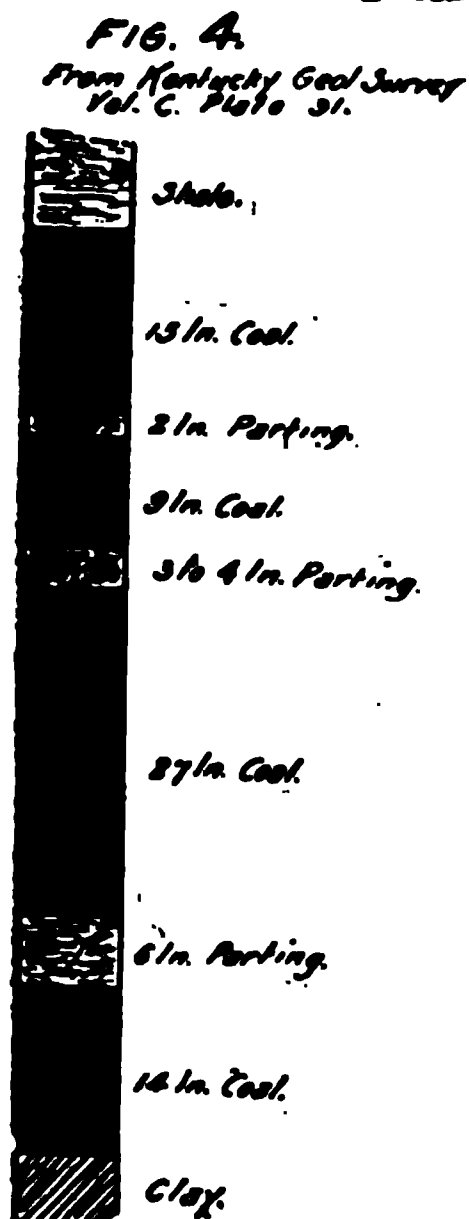
The owners of the Peach Orchard mines and also the Kentucky Geological Survey, part 5, Vol. 6, p. 21, mention two workable coals on Nats creek, above the level of the Peach Orchard coal, but no openings into them were now open.

To the south of the mouth of Nats creek about two miles another vein of coal, reported to be from 4 to 5 feet thick, lies at the level of the river, and is at times dug to supply coal to the small river steamers. This is probably the No. 1 coal of the Kentucky Geological Survey, which is so well and so favorably known all along the river from this place almost to Pikeville, Ky.

Quantity of Coal in Laurence County, Ky., on the Levisa Fork.—The estimated area bearing workable coal in the hills is 96 square miles. The area furnishing 3 feet of clean merchantable coal is estimated at 30 per cent. of the 96 square miles, or 28.8 square miles. 28.8 square miles, at 640,000 tons per foot per square mile, gives 55,296,000 tons.

Johnson County, Ky.—White House Creek.—This creek enters the Levisa Fork from the east, on the north edge of Johnson county, Ky. At its mouth is located a village of the same name, the terminus of the Chesapeake & Ohio Railroad, and a cannel coal mine that has been shipping cannel coal on the railroad for over ten years. These mines have nearly exhausted the deposit of cannel coal at this place and expect to remove to another loca-

Peach Orchard Coal.



tion in a short time. They have shipped from 5,000 to 10,000 net tons of cannel coal per year. The cannel coal has averaged about 20 inches thick, and in some places ran for 24 and 26 inches over considerable areas. There is a variable amount of soft coal with the cannel, sufficient to bring the entire vein up to 30 and 36 inches thick.

The Kentucky Geological Survey Chemical Report, Vol. A, part 3, page 181, gives the following analysis of this coal; also in Vol. A, part 1, page 275:

	A	B
Moisture	1.20	2.00
Volatile combustible matter	41.80	38.20
Fixed carbon	46.00	51.00
Ash	11.	8.80
Sulphur .....	.96	.956

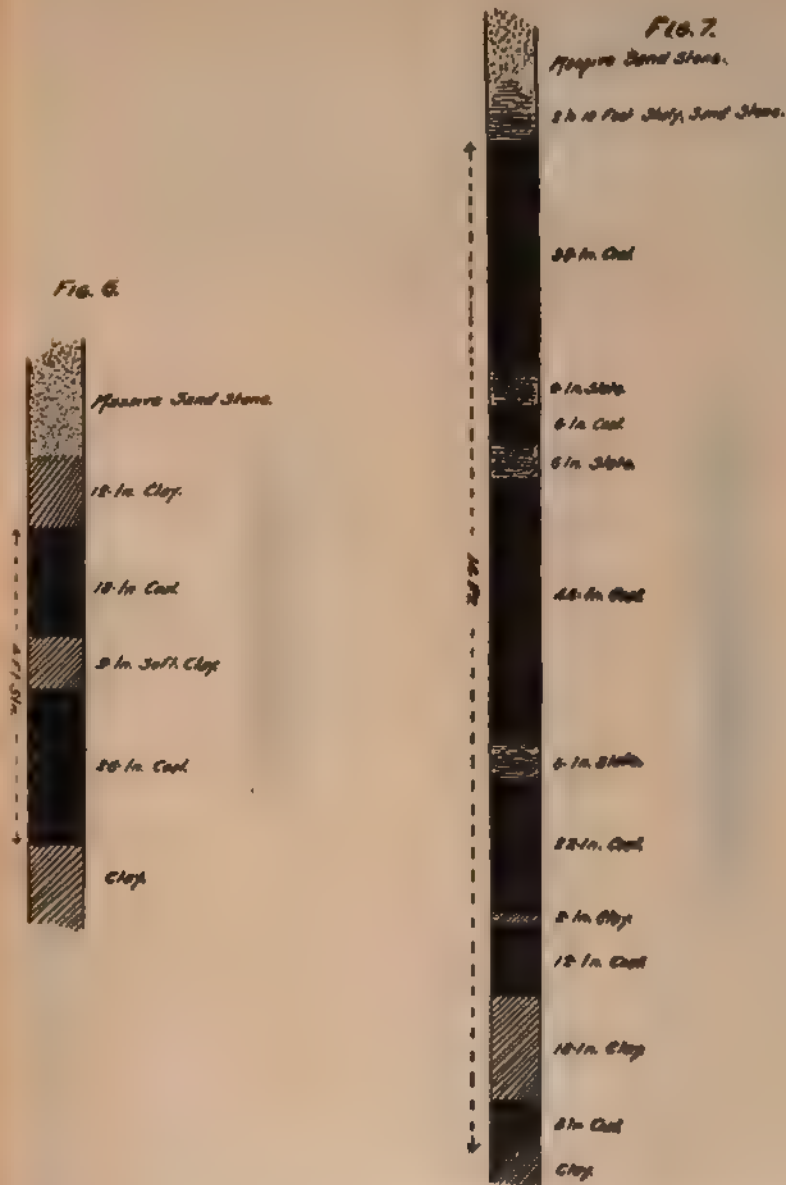
On White House creek the following section of the hill was measured:

	Feet above river.
Top of hills	650
12-foot coal (level of low gaps)	470
4-foot coal	425
3-foot coal	360
Cannel coal	90

The opening into the “3-foot” coal had fallen in, so that no measurement could be made. The thickness and structure of the “4-foot” coal is shown in Fig. 6, and the thickness and structure of the “12-foot” coal is shown in Fig. 7. Both coals were well opened and shown.

The “12-foot” coal is found and has been opened at several places along the high ridge from this place, at the head of White House creek, south for about 15 miles to the high ground between Johns creek and the heads of Wolf creek and the Middle Fork of Rock Castle creek. From this latter place to the south and east it is not recognized and either runs above the hilltops or the partings thicken up and make a number of thin veins instead of one, so that it has not been identified.

Coal No. 1 in Johnson County, Ky.—This coal has a wide development in this county, and because of its being near the stream levels has been very generally opened, by the people for local use. It varies from 30 to 50 inches in thickness and is ordinarily known as the 4-foot coal. The following statements are partly from my

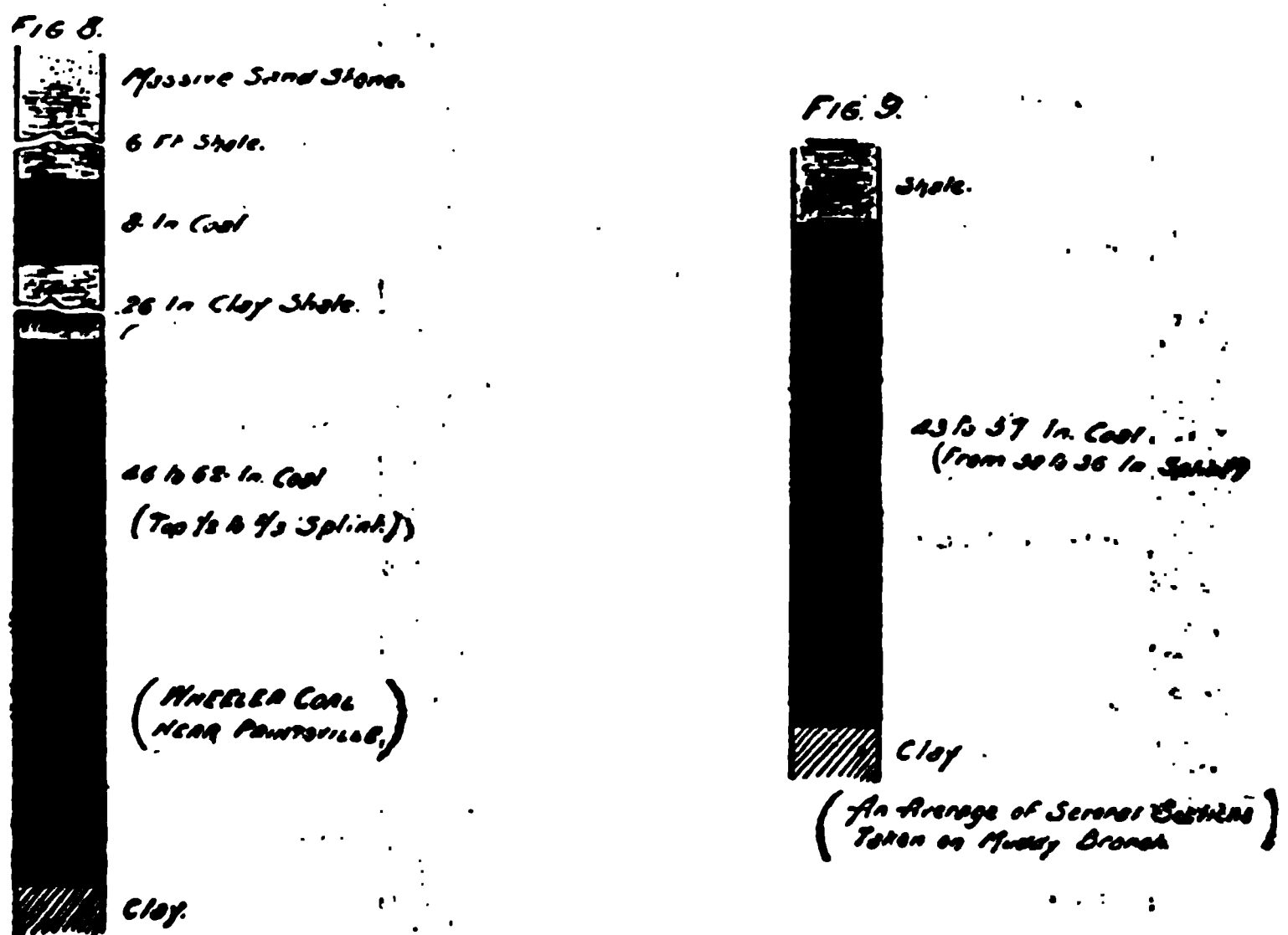


own observations and partly from the Kentucky Geological Reports, part 5, Vol. 6, second series.

On the upper part of Georges creek, in this county, the No. 1

coal averages 36 inches thick, and on Toms creek it runs from 36 to 42 inches, all solid clean coal, with no partings, and on both creeks it is low in the hills.

Around Paintsville, the county seat of Johnson county, it is usually over 4 feet thick, with no partings, and often reaches 5 feet, and about 100 feet above the river. See Figs. 8 and 9. Two miles up Paint creek, west of Levisa Fork, it shows full 4 feet, and on Lick Fork of Jennys creek, on west of Levisa Fork, and



on Little Paint creek of Levisa Fork, on the west, it ranges from 36 to 48 inches in thickness and lies near the high-water mark.

On Greasy creek, on the east of Levisa Fork, this coal lies low in the hills and ranges from 3 to 4 feet thick, of a solid clean coal with a good roof and no partings.

On Buffalo creek, also on the east of Levisa Fork, it measures from 40 to 48 inches thick with the same character as on Greasy creek. For several miles on this creek it is not over 40 feet above high-water mark.

On Millers creek, east of Levisa Fork, it lies very low and sel-

dom runs less than 4 feet thick, more frequently reaching 5 feet, and has the same character as above mentioned. (See Fig. 10.)

On Daniels creek, east of Levisa Fork, the coal averages very nearly 50 inches thick and is very near the high-water mark for several miles along the creek.

Along the lower part of Johns creek the coal lies below the high-water mark and averages about 52 inches thick. (See Fig. 11.)

In all this area the coal is without partings and as a rule has a good shale roof. It is usually from one-third to two-thirds of a

FIG. 10.

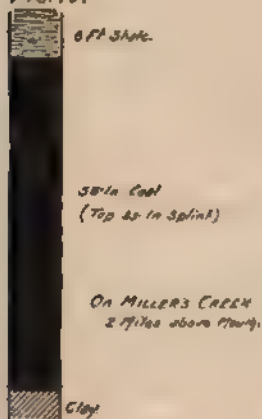
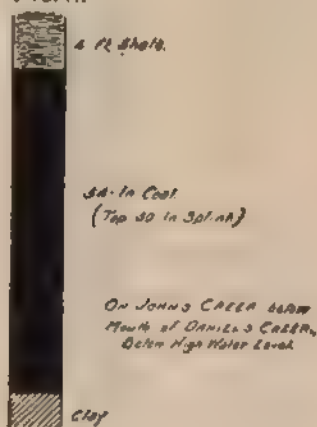


FIG. 11.



good quality of splint coal. The remainder is of a splinty nature, but it is ranked as ordinary bituminous coal.

This No. 1 coal covers a large percentage of Johnson county, because wherever the streams cut deep enough the coal is found and is seldom less than 3 feet thick.

The following analyses and sections give the composition and details of structure of the coal at a number of places. The sections are all measured for this report. (See Figs. 8, 9, 10 and 11.)

Analyses of the No. 1 coal in Johnson county, Ky., from the Kentucky Geological Survey Reports, part 5, Vol. 6, p. 13:

A. From Smiths branch of Paint creek.

B. From Wheeler's bank, near Paintsville.

C. From Rice's bank, on head of Jennys creek.

	A	B	C
Moisture	2.90	2.66	3.10
Volatile combustible matter	39.10	38.04	38.68
Fixed carbon	51.34	56.30	53.50
Ash	6.66	3.	4.80
Sulphur	4.53	1.29	1.74

This coal mines in large lumps and stands handling and stocking very well. It is a fine domestic and steam coal.

CANNEL COALS OF JOHNSON COUNTY, KY.

The cannel coals of Johnson county, Ky., have attracted much attention from coal operators and have been quite well prospected and explored in some localities. Cannel coal is mined in a large way for the railroad markets in two places in the county, viz., at White House and on Greasy creek, on the east side of the Levisa Fork and about 8 miles south of White House, and the terminus of the railroad. The coal company on Greasy creek has built a tramroad at a great expense from their mines to the railorad.

The cannel coal has been found on Millers creek and Daniels creek on the east of the Levisa Fork, and on Toms creek, Jennys creek and Lick Fork on the west side of the Levisa Fork. Much of the coal land on the above-named creeks is now owned by large companies, who expect to develop the coal and open mines as soon as some reliable means of transportation is provided.

The cannel-coal horizon is continuous, and from 3 to 5 feet of coal of some character is found at all places where it has been sought for properly; but, as is to be expected, the cannel coal

itself is not continuous, but is at times replaced, in whole or in part, by ordinary bituminous coal or splint coal, or a mixture of them; but the cannel coal is found at so many places in good thickness that there is no doubt but that this region contains many large and valuable deposits of cannel coal that will sustain large workings in the future. Large areas are found that show a thickness of cannel coal from 18 inches to 26 inches, with a variable amount of bituminous and splint coal to make a total vein of from 3 to 5 feet. In the southern edge of this county at



Eastpoint, on the county line between Johnson and Floyd counties, and about one-half mile west of the Levisa Fork, this cannel coal assumes a very unusual thickness of 51 inches. Fig. 12 shows the measured section of the Eastpoint coal. Fig. 13 was measured in Wells hollow of Daniels creek, and shows an average section of a large area in that locality.

The cannel coal usually lies well up the hill along the main streams, as it is from 100 to 200 feet above the No. 1 coal described above.

The following analyses show the composition of the cannel coals of this region: Samples A, B, C and D were obtained from the reports of expert engineers employed by the various coal companies. All the others were taken from the reports of the Kentucky Geological Survey, as follows: E from "A preliminary report on Morgan, Johnson and other counties," p. 15. F, G and H from Chemical Report, Vol. A, part 3, p. 62.

A. } Top of vein.
B. } Eastpoint cannel coal.
C. Bottom of vein. }

D. From ridge between Buffalo and Greasy creeks.

E. From Lick branch, Johnson county.

F. From Smiths branch of Paint creek; 18 inches of cannel coal, overlaid with 18 inches of common coal; samples from cannel coal.

G. From 22 inches of cannel coal on W. T. Hager's land, 1 mile north of the mouth of Little Paint creek.

H. From the lower 8 inches of sample G.

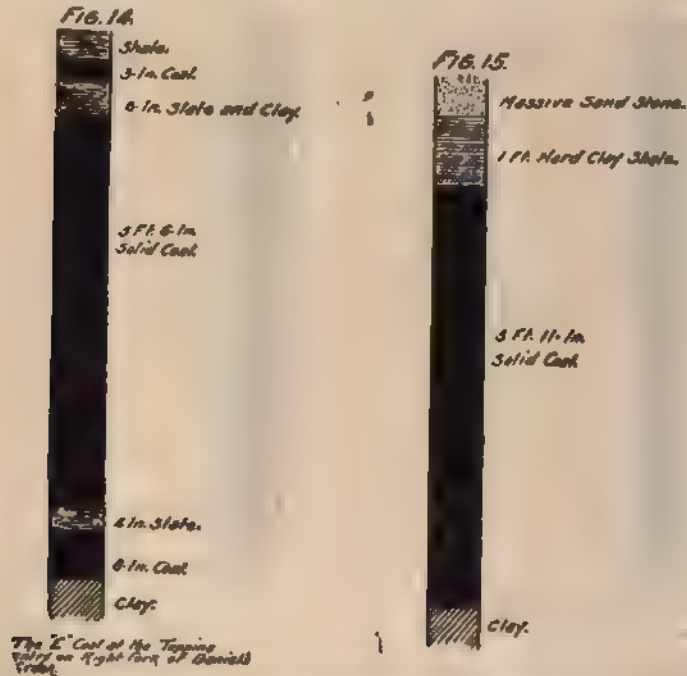
I. From Walter Fletcher's land on Little Paint creek. Cannel coal from the upper 22 inches of the 43-inch bed.

J. From same place as sample I, but is the lower 21 inches of the 43-inch bed and is a splint or bituminous coal.

	A	B	C	D	E	F	G	H	I	J
Moisture	0.56	0.78	1.20	55.88	2.	3.	1.80	1.80	1.44	2.56
Volatile matter	59.99	46.83	64.39	55.88	38.20	49.80	49.10	49.20	50.22	39.94
Fixed carbon .	31.71	33.46	26.36	35.75	51.	37.94	41.16	44.	40.74	54.10
Ash	7.72	8.91	8.05	8.37	8.80	9.26	7.94	5.	7.60	3.40
Sulphur	1.25	1.35	1.67	....	.956	2.609	.816	.846	.837	1.030
Phosphorus ...	.011	.009	.010	....	....	....	....	....	....	....
Specific gravity	....	....	....	....	1.291	1.279	1.248	1.223	1.242	1.275

OTHER COALS OF JOHNSON COUNTY, KY.

Besides the No. 1 coal and the cannel coals described above, there are at least three other coals of workable thickness in parts of this county. In the eastern part of the county, on the heads of Daniels creek, Millers creek, Buffalo creek and Greasy creek, the southern extension of the Peach Orchard coal is found, with a thickness ranging from 8 to 11 feet, and is commonly known as the "10-foot" seam. In this county it has so far shown quite



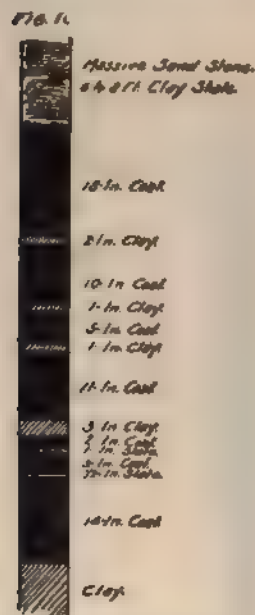
a number of thin slate partings that will discourage its working until the better coals have been pretty well worked out. (See Fig. 16.)

From 65 to 80 feet above the Peach Orchard coal is a fine coal commonly known as the "6-foot" coal and locally as the E coal, and from 135 to 160 feet above the E coal is the F vein, which is the same as described above as the "12-foot" coal vein on White House creek, and shown in Fig. 7. No measurement of this big

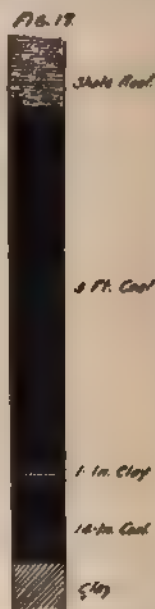
coal could be obtained in this region, but it was reported by reliable persons as being very like the section shown in Fig. 7. It is near the hilltops, and is now considered to be of very little economical value.

On the head of the right fork of Daniels creek, at the "Toppins" entry on the Simpkins' land, the E coal was measured as shown in Fig. 14. (See Fig. 17.)

On George Goble's land, on the head of Millers creek, the E



On Goble's Land on Millers Creek,
300 feet above No. 1 Coal



The "E" Coal on Honey Branch of
Rockcastle Creek

coal is 440 feet above the No. 1 coal in the creek bed, and has the section shown in Fig. 15.

Also on George Goble's land a coal about 300 feet above the No. 1 coal, and believed to be the representative of the Peach Orchard coal has the section shown in Fig. 16. It is claimed by persons who have opened this coal at other places that the three small clay partings in the upper part are not continuous.

Little or no prospecting has been done in the high ground in the southwestern part of Johnson county, so that it is not known

whether these upper coals hold their thickness in this area or not, but it is reasonable to assume that at least one of them will be of workable thickness.

QUANTITY OF COAL IN JOHNSON COUNTY, KY.

The following estimate is offered as a conservative statement of the probable amount of the most available coal of the county. No. 1 coal is estimated to average 3 feet 8 inches thick over 50 per cent. of the county.

The cannel coal is estimated to average 3 feet thick over 10 per cent. of the county (including the bitumionous coal of the vein.)

Peach Orchard coal is not estimated on account of the large number of slate partings in it.

The E coal is estimated to average 5 feet thick over an area in the eastern part of the county 4 miles wide and 10 miles long.

The F coal is not estimated on account of the partings and because of its high position in the hills and the small acreage.

The above estimate gives the following quantities:

	Square Miles	Tons
No. 1 coal	135	316,800,000
Cannel coals	27	51,840,000
The E coal	16	51,200,000
Total for Johnson County .....	.....	419,840,000

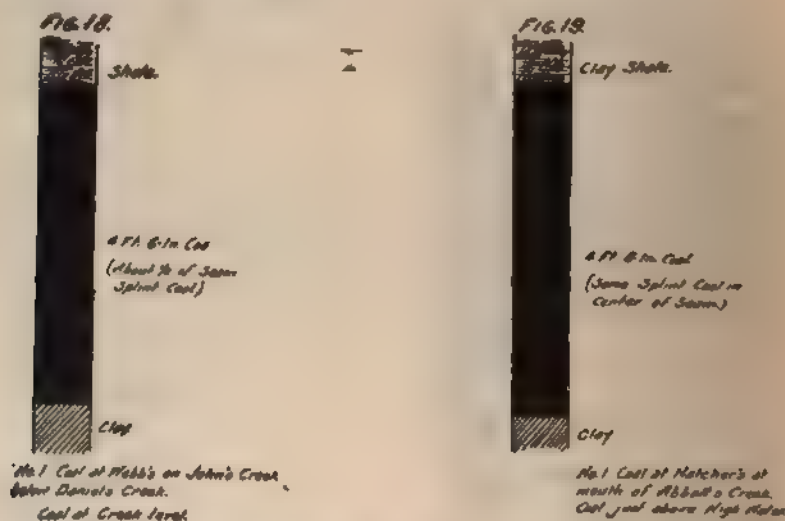
FLOYD COUNTY, KY.

Floyd county, Ky., lies on both sides of the Levisa Fork, south of Johnson county and northwest of Pike county, Ky. The larger part of the county lies on the southwest side of the river and is drained by Little Paint, Abbotts, Middle, Bull, Beaver, Prater and Mud creeks, all tributaries of the Levisa Fork on the west

side. That part of the county to the east of the river is drained by Johns creek and its branch, Buffalo creek, and by Cow, Ivy and Mare creeks, emptying directly into the river from the east.

Coal No. 1.—The No. 1 coal of the Kentucky Geological Survey extends into this county from Johnson county and is widely distributed through this county and is often known as the Prestonburg coal.

At the mouth of Little Paint creek and of Johns creek the coal lies near the level of high water, and averages about 4 feet 4 inches thick. (See Fig. 18.)

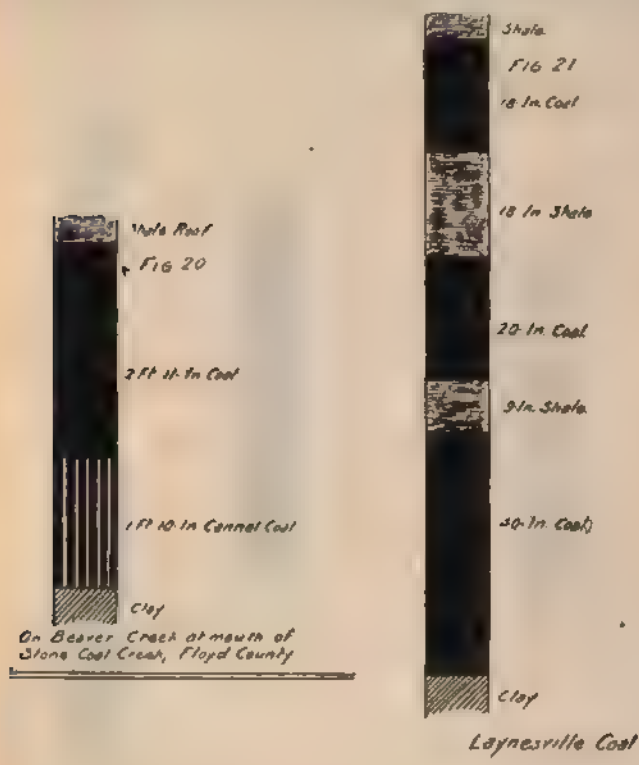


At Hatcher's, at the mouth of Abbotts creek, it is 4 feet 8 inches thick and at high-water level. (See Fig. 19.)

At both the last-named places it is a clean, solid coal without partings. On the head waters of Abbotts creek the coal thins out to about 3 feet or 3 feet 6 inches.

At Harris' bank, near Prestonburg, it shows 44 inches at about 100 feet above the river level. At Fitzpatrick's bank, about 3 miles up Middle creek, it is only 3 feet thick and at the creek level; it is reported to hold its thickness for a considerable distance up Middle creek. On Bull creek it is opened for local use, and is reported as about 4 feet 6 inches thick. On Beaver creek this

coal lies low and has a thickness ranging from 3 to 5 feet, the maximum being found on the right fork of Beaver creek from the mouth of Rocky Fork to Caney creek, and including portions of the valleys of all the tributaries between. At the mouth of Stone Coal branch of the right fork of Beaver creek the No. 1



*Figures 21, 23, & 25 are taken from
the Kentucky Geological Reports.*

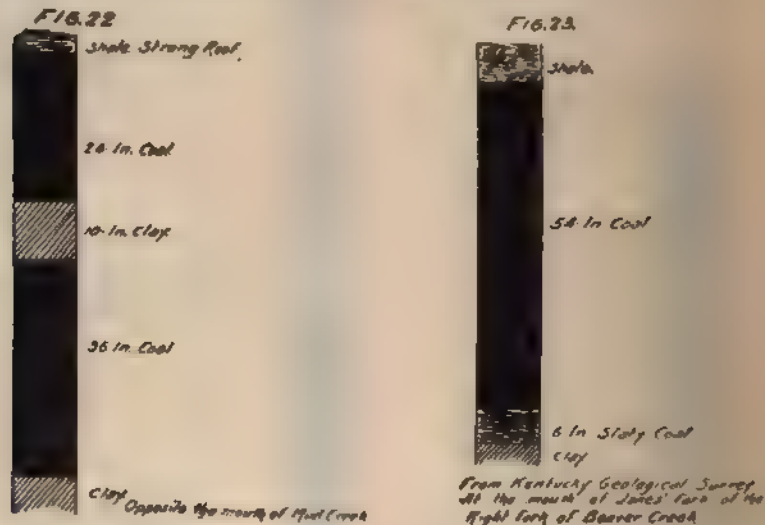
coal has some cannel coal in it, but it is thought that the pocket of cannel coal is of small extent. (See Fig. 20.)

A coal of considerable thickness has been dug out of the river bed a short distance above the mouth of Prator creek, and also about the mouth of Ivy creek, which is probably the No. 1 coal.

The coal about Laynesville and the mouth of Mud creek is usually assigned to the horizon of the No. 1 coal, although this

coal has a large clay parting in the central portion, and the No. 1 coal has been characterized by having no partings, at all points to the north down the river.

The geology of this region has not been thoroughly worked out and the complete section not yet determined. While there is some doubt as to the true order, the Laynesville coal and mouth of Mud creek coal will be here counted as the No. 1 coal. For the structure of these coals see Figs. 21 and 22.

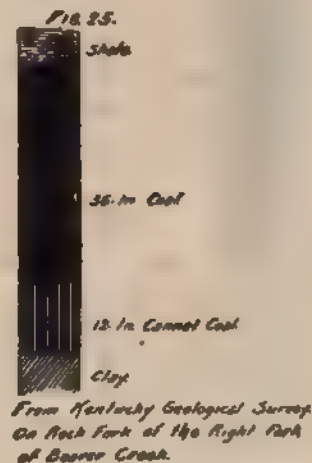
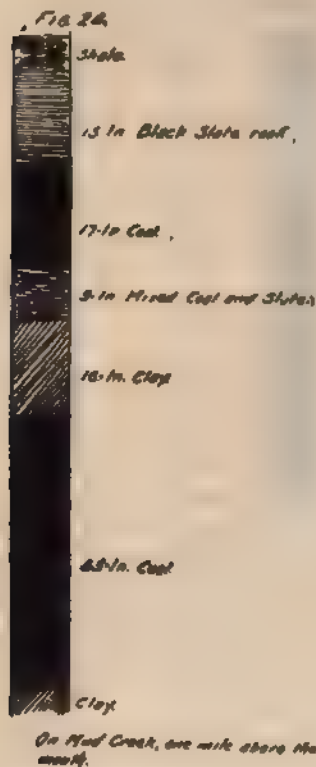


In the eastern part of the county the No. 1 coal starts up Johns creek about the high water level and is thought to go under the creek bed in a few miles above the mouth of Daniels creek. But some good coals have been opened recently near the creek level in the extreme eastern edge of the county on Johns creek that are hard to classify, if they do not belong to the horizon of the No. 1 coal. The coal is found all along the eastern side of the river valley, the same as on the western side.

The accompanying figures show the structure of this coal in various parts of the county.

In the extreme eastern edge of the county, between Mud and Hurricane creeks, on the south side of the river, the No. 1 coal

was mined, in a large way, for several years, some thirty-five or forty years ago, and shipped in barges to the large cities on the Ohio river. The work was discontinued on account of the great loss of barges on snags and rocks and on account of the lack of navigable stages of water during the summer and fall. The coal is reported to have been from 5 to 6 feet thick, with a large

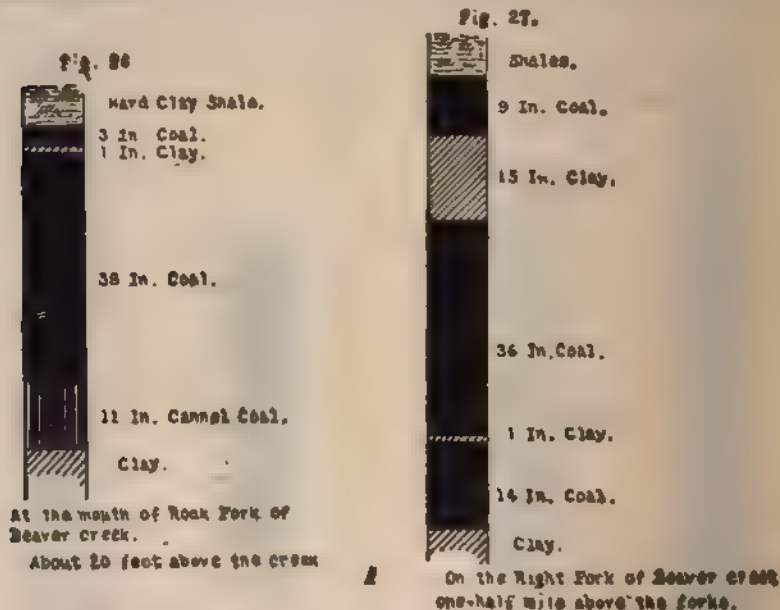


clay parting near the center. It is probable that the section from Mud creek, Fig. 24, represents the coal fairly well.

The following analyses from the Kentucky Geological Survey Reports show the quality of this coal at several points. Very often a considerable portion of the seam is good splint coal, making a very desirable domestic and steam coal, and one that stands much rough handling and one that stocks well.

CANNEL COAL IN FLOYD COUNTY.

The cannel coals of Johnson county pass into Floyd county in undiminished thickness and quality, but they do not seem to be as widely distributed, or at least not as well known as in the first-named county.



On Abbotts creek the cannel coal is found in a number of places with a reported thickness of 20 to 24 inches, with about 24 inches of bituminous, splinty coal over it. In one place a thickness of 37 inches, without any bituminous, is claimed.

On Middle creek and its branches cannel coal has been found at several places widely separated, but no reliable information can be obtained except that it was thick enough to pay for working if there was any means of shipping it.

On Beaver creek the cannel coal at the mouth of Stone Coal branch has been described and shown in Fig. 20. Another coal horizon was persistently reported on Beaver creek and its branches as being 300 or 400 feet up on the hills, but no openings could be found or heard of. It has been frequently exposed in land slides.

Cannel coal was also reported on the head of Prator creek and on the higher ridges around the heads of Mud and Toler creeks. It is probable that the cannel coal reported on Prator, Mud and Toler creeks may be the same cannel coal as opened on the land of the Widow May, on Bear Fork of Robinson creek, of Pike county, and described below. It may be, too, that the cannel coal reported on the Beaver hills belongs to this same horizon. The geological section has not yet been well worked out in this district, and the equivalency of coal horizons at distant points can not be stated with a very high degree of certainty.

On the eastern side of the Levisa Fork a few thin cannel coals have been found on Johns creek, and near Prestonsburg along the river. It is probable that the Daniels creek cannel coal extends up Johns creek, and that workable deposits will be found as the country is more thoroughly explored and prospected.

OTHER COALS OF FLOYD COUNTY, KY.

On Mud, Prator and Beaver creeks and its branches two other coals are very generally reported above the No. 1 coal besides the cannel coal. These coals have been opened in a few places in the past for trial and local use, but no openings could now be found where measurements could be made. In the high ridge around the head of Beaver a still higher coal was reported, but little could be learned about it. On Middle creek a 5-foot coal is very generally reported near the hilltops, but no openings could be found. It is probably the same as one of those reported around the head of Beaver creek.

On the eastern side of the county no coals of note are known but up Johns creek just across the county line in Pike county the hills carry a 4-foot and a 6-foot coal that ought to be found in the Floyd county hills.

QUANTITY OF COAL IN FLOYD COUNTY, KY.

The entire area of Floyd county, about 405 square miles, is drained by the Levisa Fork and its tributaries. The entire county

can be called coal-producing territory, as nearly every farm has at least one workable coal vein and in a considerable portion of the county two workable veins are found in the same hill. The coal that can be gained and put in the markets is estimated at 100 square miles, 4 feet thick. This makes 100 square miles by 4 feet by 640,000 tons, or 256,000,000 tons.

ANALYSES OF FLOYD COUNTY COALS.

From the Kentucky Geological Survey Chemical Report, Vo. A, part 1, p. 248:

A. From Snipe's bank, on branch of Abbotts creek. About 2 feet shown. A splint coal.

B. From Harris' bank on Muddy creek, 1 mile from Prestonsburg, coal 44 inches thick.

C. From J. H. Hatcher's bank at mouth of Abbotts creek. (See Fig. 19.) From Kentucky Geological Survey Chemical Report, Vol. A, part 2, p. 186.

D. From mouth of Mud creek. Upper 18 inches of seam. (See Figs. 22, 24.)

E. From same bed as D. Lower 3 feet 5 inches. (See Figs. 22 and 24.)

F. Laynesville coal. Middle of the upper part of the opening, measuring 23 inches. A splint coal. (See Fig. 21.)

G. From the same bed as F, lower portion measuring 45 inches. (Fig. 21.)

H. Coke made from sample F.

I. From mouth of Steel creek of Beaver creek. Average of the upper 4 feet of seam.

J. From Flemmings (or Jacks) creek, left fork of Beaver creek. Sample from a new outcrop of 5 feet 4 inches in thickness without the parting. Some clay unavoidable in the sample. A weathered sample of splint coal.

	A	B	C	D	E	F	G	H	I	J
Moisture	3.20	2.60	2.50	2.04	2.10	1.30	1.90	5.	2.50	3.80
Volatile matter	38.80	40.80	38.56	37.42	37.16	36.70	35.30	....	32.50	33.80
Fixed carbon .	55.04	56.70	53.44	56.34	57.74	51.70	58.94	88.50	56.54	60.60
Ash	2.96	3.24	5.50	4.20	3.	10.30	3.86	6.50	8.46	1.80
Sulphur	1.289	1.895	1.915	1.475	.596	1.356	.715	.788	.651	.475
Specific gravity	1.289	1.274	1.307	1.302	1.281	1.359	1.284	....	1.323	1.350

KNOTT COUNTY, KY.

The branches of Beaver creek extend over into Knott county and drain about 102 square miles of that county.

The No. 1 coal is mostly below drainage, but has a good thickness of 4 to 5 feet where it goes under. The cannel and higher coals referred to in the Floyd county description as being around the head of Beaver creek applies to this area in Knott county as well. This district has been prospected but very little, so that no details of the coals can be here given, but it is believed that the following estimate is well within limits: Twenty-five square miles of coal land with coal 4 feet thick gives 25 square miles by 4 feet by 640,000 tons or 64,000,000 tons.

PIKE COUNTY, KY. (SOUTHERN PORTION.)

This large county is the most eastern county in Kentucky and bounds on both Virginia and West Virginia, and is drained by both forks of the Big Sandy river. The portion drained by the Levisa Fork and its branches is here described. The portion drained by the Tug Fork will be taken up later.

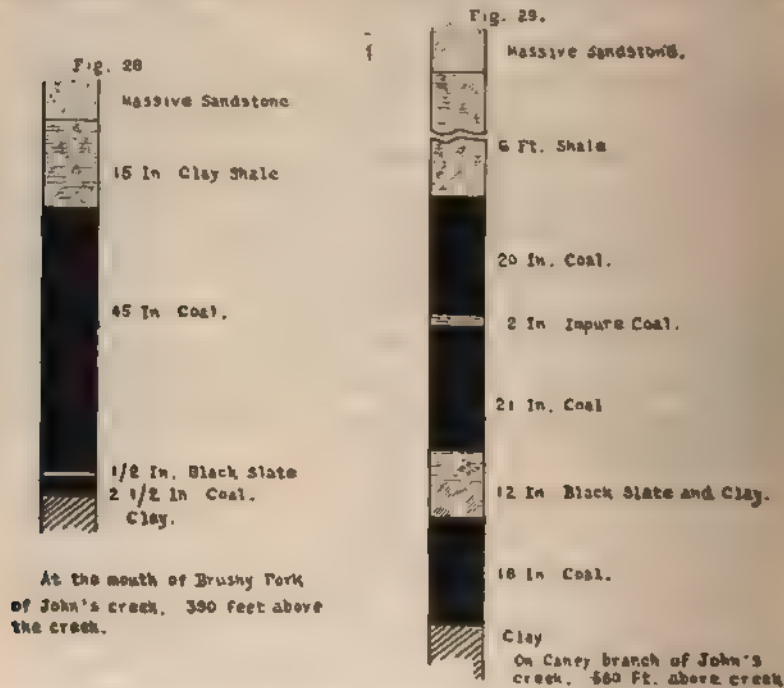
While it is not expected that the proposed slack-water navigation will extend clear through Pike county, it is considered that the entire coal field of the county is tributary to the river, and could furnish traffic to it by the construction of tramroads or cheap railroads of a few miles length up the larger streams. It

is understood that this has been done on the Kanawha river. There seems no apparent reason why the slack-water improvement might not be extended into Virginia.

JOHNS CREEK.

This large stream heads in Pike county, Ky., to the east of Levisa Fork and between that fork and the main dividing ridge between the waters of the Levisa and Tug Forks.

On Johns creek, at the mouth of Brushy Fork, in the extreme northwestern corner of the county, a "4 foot" coal has been

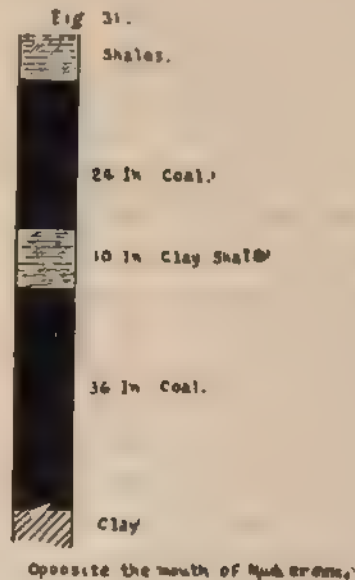
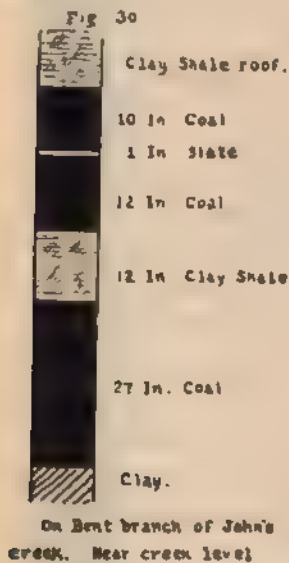


opened and has the structure shown in Fig. 28. This coal is 390 feet above Johns creek, and has several hundred feet of hill over it. In the same hill six other coal veins were opened, but they were all thin, so that their sections are not given.

A few miles up Johns creek on Caney branch, on the lands of J. Harvey Leslie, "6 foot" coal is opened, and has the structure shown in Fig. 29. An analysis of this coal is given below. On this

same land is found the iron ore described in the first part of this report. The "6-foot" coal is 580 feet above Johns creek, and has about 300 feet of hill over it. In the same hill 7 other coals were opened, but they are all of no commercial value at this place, as they are either thin or full of thin partings.

On Bent branch of Johns creek, and about $1\frac{1}{2}$ miles from Johns creek, the coal shown in Fig. 30 is found near the creek level. The same coal is mined on Coon creek, a fork of Johns creek, for local use. An analysis of the Bent branch coal is given below.



The Kentucky Geological Survey gives an analysis (see below) of a "50-inch coal" found on Stinking creek, a branch of Johns creek. No section nor its location in the hill is given.

Reports of other coals high in the hills around the head of Johns creek were heard, but no openings could be found. Inasmuch as considerable land on the head of Johns creek has been bought by coal companies as an investment, it is reasonable to suppose that there is good coal of merchantable value to be found there.

TRIBUTARIES ON THE NORTH SIDE OF THE LEVISA FORK.

At the western edge of the county, opposite the mouth of Mud creek, a coal about 75 feet above the river valley gave the section shown in Fig. 31.

The Kentucky Geological Survey, in "A report on the Southeastern Kentucky coal field," publishes the following section of the hill at the mouth of Stone Coal creek, about 5 miles down the river from Pikeville:

At 560 feet above the Levisa Fork, coal 4 feet thick or more; cannel coal on top.

At 355 feet above the Levisa Fork, Gilliam's coal (Fig. 32).

At 200 feet above the Levisa Fork, coal 3 feet thick (Fig. 33).

At 140 feet above the Levisa Fork, coal 1 foot thick.

At 80 feet above the Levisa Fork, coal 2 feet thick.

The same Kentucky report as mentioned above also gives the following coal sections on Little Chloe creek opposite Pikeville. The coal in Fig. 34 is 410 feet above the river, and that in Fig. 35 is about 40 feet above the river. The latter coal is called the "Syck's" coal and is mined for use in Pikeville. Its analysis is shown below:

On Ferguson creek opposite Pikeville and just down stream from Little Chloe creek a coal is mined for use in Pikeville. It is 330 feet above the river and has from 400 to 500 feet of hill over it. Its structure is shown in Fig. 36.

The following are analyses of Pike county coals taken from the Kentucky Geological Survey Chemical Report, Vol. A, part 3, pp. 189 and 193:

- A. Coal from Leslie's land on Caney creek of Johns creek.
- B. Coal from Bent branch of Johns creek.
- C. Coal from Andrew Collins' land on Stinking creek of Johns creek.

Moisture	3.80	1.60	1.46
Volatile matter	28.	34.60	31.34
Fixed carbon	57.20	57.40	56.80
Ash	11.	6.40	10.40
Sulphur .....	.59	1.703	727

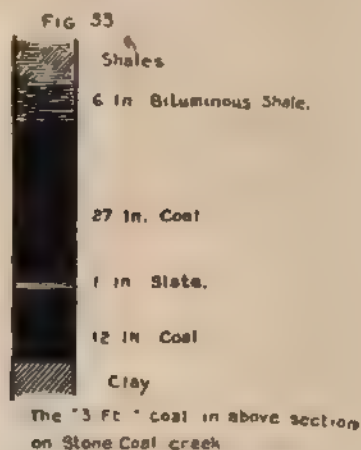


Fig. 32 is the Gilliam coal in the above section on Stone Coal Creek

Figs. 32 & 33 are from the Kentucky Geological Survey Report on the South-eastern Ky. Coal Field.

The miners at this mine report two other workable coals in this same hill, one above and the other below, and both between 3 and 4 feet thick. Mr. William J. Love, an English mining engineer, in a special report on some Pike county coals to a coal company, speaks of the coal on Ferguson's as a 7 foot vein, and gives the following analyses of the top and bottom benches. Mr.

Love also notes the Syck's coal on Little Chloe creek, and gives the following analysis of it. The analysis of the Syck's coal by the Kentucky Geological Survey is also given:

A. Top bench of coal on Ferguson's creek. From Love's report.

B. Bottom bench of coal on Fergusons creek. From Love's report.

C. Syck's coal on Little Chloe creek. From Love's report.

D. Syck's coal on Little Chloe creek. From Kentucky Geological Survey.

	A	B	C	D
Moisture	1.60	1.68	2.46	5.06
Volatile combustible matter	41.	35.55	39.10	29.84
Fixed carbon	50.37	56.62	50.40	57.50
Ash	7.	6.10	8.	7.60
Sulphur .....	.03	.09	.04	1.04
Specific gravity .....	.....	.....	.....	1.367

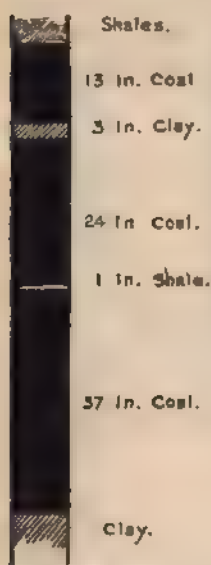
The thick coal on Fergusons creek has been traced and opened on the head of Little and Upper Chloe creeks and in the hills around the two Pompey creeks. No openings could now be found where the thickness could be measured, but the local reports seemed reliable and were very general and persistent. The special report of Mr. Love, above-mentioned, and also another special report made by Mr. R. N. Dickman, a coal expert of Cleveland, Ohio, mentions this thick coal on the above-mentioned creeks and gives sections showing that it holds its thickness over a large area.

While this coal is from 300 to 400 feet above the river it has fully as much more hill over it in all the ordinary ridges and considerably more in the main ridges between the head of Johns creek and Tug Fork and the Levisa Fork. There is a very large acreage of this coal in this immediate district.

SPECIAL REPORTS TO PRIVATE COMPANIES.

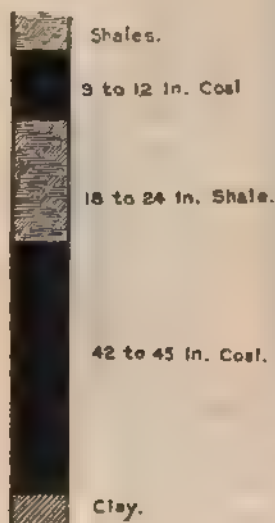
A word in regard to the special reports above referred to may be in order at this place, as they will be quoted again in reference to the Pike county coals. These reports are kindly furnished me by Mr. John C. C. Mayo, of Paintsville, Ky., and permission given to use such parts as found desirable. Many of the measurements of the thickness of coal seams were checked, but it was impossible to check all of them. Those checked were found to

FIG. 34.



On Little Chloe Creek and
410 feet above the Creek.

FIG. 35



Syck's Coal, on Little Chloe Creek.
About 30 feet above the Creek

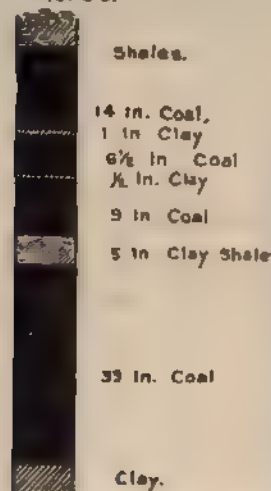
(From Kentucky Geological Survey

agree so closely with the reports that all are considered to be thoroughly reliable. The analyses could not be checked except in a slight extent by a comparison with the few analyses of the Kentucky Geological Survey that happened to be from the same places. This comparison indicates that the analyses may also be taken as correct, because such differences as were found can easily be accounted for by local variations in the coal and from the fact that nearly all the coal samples from this region must be

taken from the crop coal. These reports will therefore be quoted and credit given in each case.

On the Levisa Fork, about 2 miles above the mouth of Russel Fork, a cannel coal has been exposed in a landslide, and has been roughly opened but not used, even locally. It could not now be measured on account of water, but Dickman's report gives the structure shown in Fig. 37 and the following analysis:

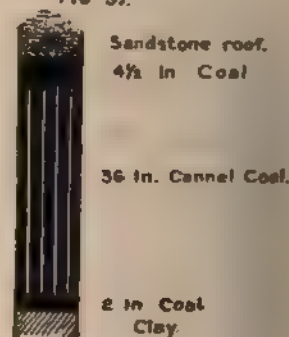
FIG. 36.



On Ferguson Creek opposite
Pikeville, and 330 Ft. above
the River.

Moisture	0 58
Volatile combustible matter	54 07
Fixed carbon	40 64
Ash	4 70
Sulphur	87
Phosphorus	011

FIG. 37.



On Levisa Fork near the mouth
of Russell's Fork.
(From Dickman's report.)

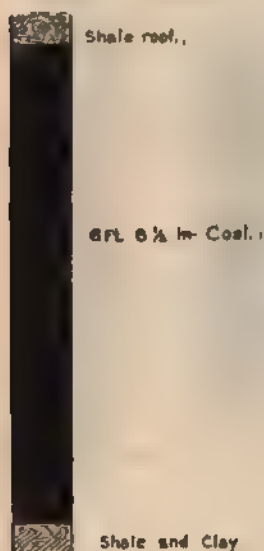
On both sides of Levisa Fork and on most of the side tributaries from the mouth of Russel Fork to the State line between Kentucky and Virginia a thick coal, probably the same as mentioned on Fergusons creek and on the Chloe and Pompey creeks, is generally known, and has been opened in many places, usually by some of the coal companies that now own large tracts of this coal land. There are also two thinner coals, ranging from 3 to 4½

feet thick, very often reported and sometimes opened, one above and one below, as on Fergusons creek.

The thick coal has been opened on Grapevine, Lick, Big, Feds and both the Card creeks.

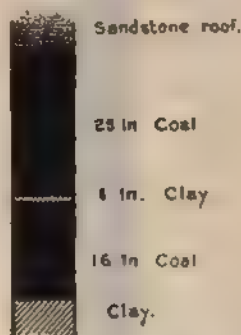
On Feds creek the section shown in Fig. 38 was measured. The coal is about 100 feet above the creek, and has from 600 to 800 feet of hill over it. On most of the streams the coal lies near the streams, so that a very large percentage of the country holds the coal, and very little has been lost by the erosion of the creek valleys.

FIG. 38.



On Fed's Creek, 100 ft. above Creek.

FIG. 39.



On Little Card Creek. One of the smaller coals below the big coal.

On Little Card creek one of the smaller coals, below the 6 or 7 feet coal, has the thickness and structure shown in Fig. 39, and is about 150 feet above the stream. This big coal has been opened above in the same hill, but the opening is now closed with debris.

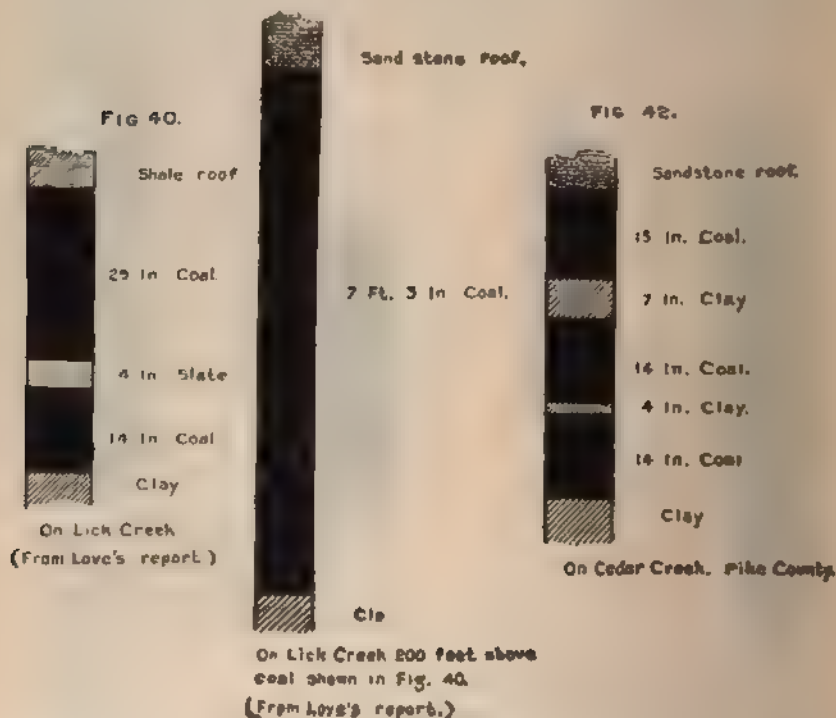
On Lick creek Love's special report gives the sections and analyses of two coals in the same hill and 200 feet apart. Fig. 40 shows the lower, which is probably the same as the lower coal on Little Card creek and shown in Fig. 39. Fig. 41 is the higher

coal, and is the thick coal so well distributed through this district.

ANALYSIS.

Moisture	7.64
Volatile matter	44.85
Fixed carbon	39.87
Ash	7.60
Sulphur .....	.04

FIG. 41.



ANALYSIS.

Moisture	6.28
Volatile matter	34.20
Fixed carbon	54.29
Ash	5.20
Sulphur .....	.08

Prof. John R. Proctor, former State geologist of Kentucky, in a special report on lands in this region to a private company, says: "The Elkhorn seam, which is No. 3 of the section, has a fine development in

this region. It is 86 inches thick near the mouth of Lick creek, 67 inches thick on Little Card creek, 74 inches thick on Big creek, and 63 inches thick on Ferrells creek (of Russel Fork). Analyses show that the bed in this region maintains its excellent quality. Two hundred feet above the Elkhorn bed, on Ferrells creek, is a coal of fine quality 75 inches thick. Two hundred feet below the Elkhorn seam, on Big creek, a coal has been opened 48 inches thick. The hills rise to an elevation of about 1,000 feet above the Levisa Fork, and we have here a section of great value."

FIG. 43.

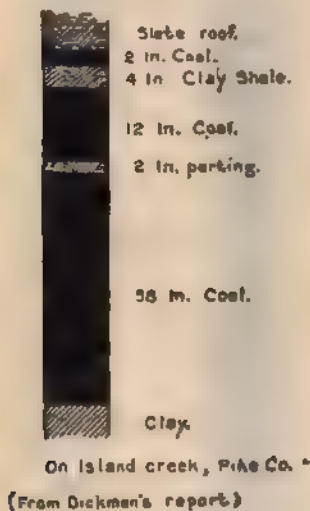
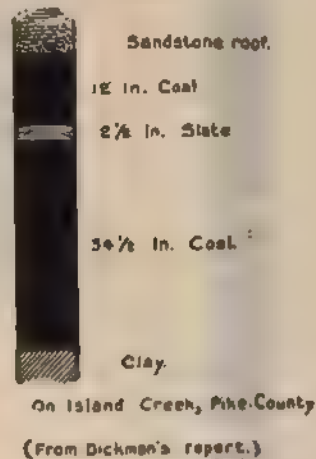


FIG. 44.



PIKE COUNTY SOUTH OF THE LEVISA AND RUSSEL FORKS.

Near the western edge of the county, on Cedar creek, two workable coals have been opened about 75 feet apart in the same hill and about halfway up the hill. The lower one could not be measured, but was reported as being about 4½ feet thick, with a central parting of 5 inches. The upper one was measured, and its structure is shown in Fig. 42.

On Hurricane creek, the next creek down the river, the lower coal is reported as full 5 feet thick with no partings. Four feet

and six inches of clean coal was seen and measured, but the bottom of the coal was covered with water, so that a complete section could not be taken.

On Island creek, which enters the Levisa Fork about 2 miles above Pikeville, Dickman's special report gives the following sections, Figs. 43 and 44, and analyses of two openings of the same coal a few miles apart, and both about 200 feet above the creek:

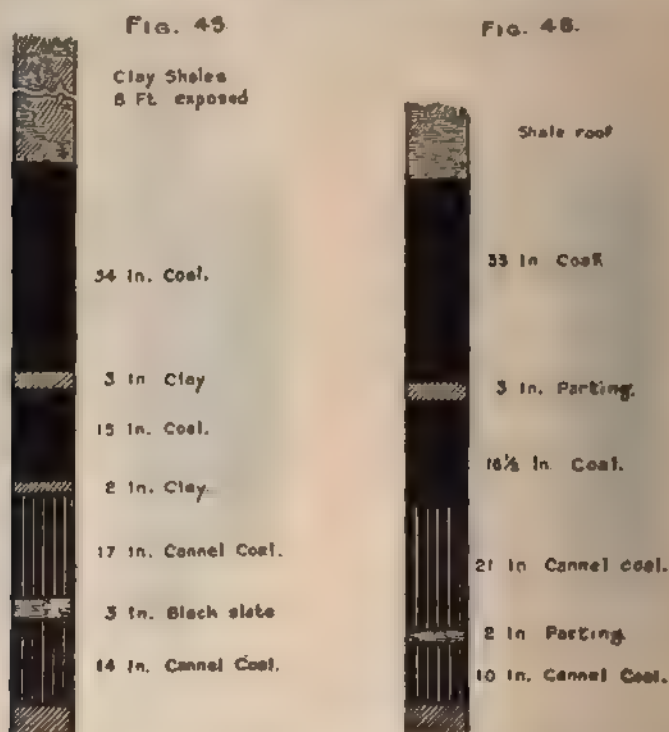


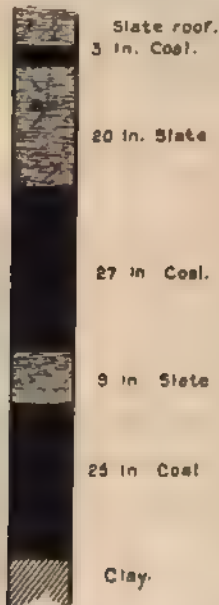
	Fig. 44	Fig. 43
Moisture ..	0.94	0.86
Volatile matter ..	42.55	38.57
Fixed carbon ..	53.39	55.67
Ash ..	3.10	4.89
Sulphur ..	.86	.70
Phosphorus ..	.103	.004

SHELBY CREEK.

Shelby creek and its numerous large branches drain a large basin which is very rich in workable coal.

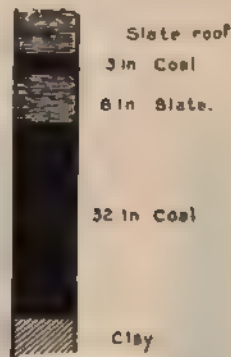
On Bear Fork of Robinson creek, of Shelby creek, on the lands of the Widow May, a large coal seam is opened 750 feet above the creek and has from 300 to 400 feet of hill over it. Fig. 45 shows

FIG. 47.



The Elkhorn coal in above section At 470 feet above Creek
(From Kentucky Geological Survey)

FIG 48



Coal at 420 feet above the Creek in the above section
(From the Kentucky Geological Survey)

the section as measured, and Fig. 46 shows the section of the same coal as published by the Kentucky Geological Survey.

The Kentucky Geological Survey gives the following section of a part of the hill containing the coal shown in Figs. 45 and 46:

At 910 feet above creek: Coal stain, part cannel. Not opened.

At 770 feet above creek. Big coal; see Figs. 45 and 46.

At 470 feet above creek: Elkhorn coal; see Fig. 47.

At 420 feet above creek: Coal; see Fig. 48.

On the left-hand fork of the Long Fork of Shelby creek the

coal shown in Fig. 49 was measured about 60 feet above the creek.

This is probably the same coal that is called the Elkhorn coal in the section of the Bear Fork hill. (See Fig. 47 as given above from the Kentucky Geological Survey.)

This coal is very low on the hill on Long Fork and has been opened at many places and is known to cover a large area.

On Indian creek, about one-half mile above the mouth of Long Fork, Dickman's special report gives the following section, Fig. 50, and analysis of a coal about 700 feet above the creek. This is probably the same as the thick coal on Bear Fork and shown in Fig. 45:

ANALYSIS.

Moisture	2.46
Volatile matter	38.02
Fixed carbon	56.91
Ash	2.61
Sulphur .....	.86
Phosphorus .....	.003

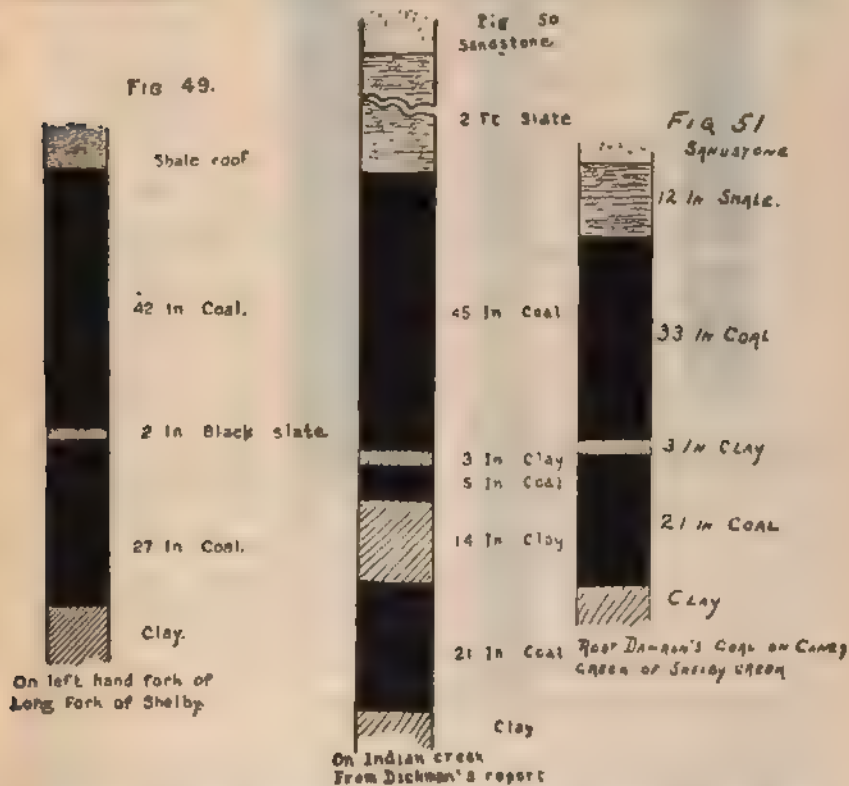
The Kentucky Geological Survey preliminary report on the Southeastern Kentucky coal field, page 18, gives the following analysis of William Hall's coal on Indian creek. Its position or its section is not given:

Moisture	0.60
Volatile matter	33.94
Fixed carbon	59.46
Ash	6.
Sulphur .....	.876

On Robert Damron's land on the left-hand fork of Caney creek of Shelby creek coal is opened in the bed of the stream, and was measured as shown in Fig. 51. Enough coal to charge a coke oven was sent from this bank to Connellsville, Pa., to test its coking qualities. The resulting coke was pronounced to be of good quality. Dickman's special report gives the section of this coal shown in Fig. 52, and the following analyses of the coal and cokes:

ANALYSIS.

	Coal	Coke
Moisture	1.14	0.21
Volatile matter	39.37	.71
Fixed carbon	54.67	90.21
Ash	4.81	8.87
Sulphur .....	.75	.692
Phosphorus .....	.006	.009

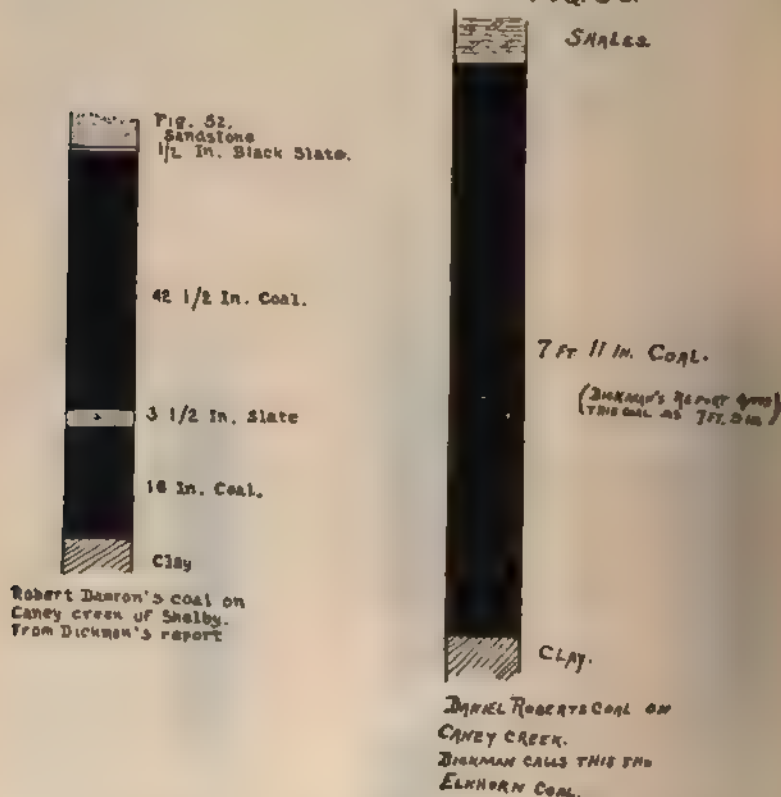


Farther up the same Caney creek and about 2 miles from Damron's bank and about 500 feet up the hill a coal is opened on Daniel Robert's land, and has the section shown in Fig. 53. Dickman's report gives this coal as 7 feet 9 inches thick, and gives the following analysis of it. Dickman calls this the Elkhorn coal:

ANALYSIS.

Moisture	1.02
Volatile matter	39.96
Fixed carbon	55.03
Ash	3.98
Sulphur .....	.91
Phosphorus .....	.004

FIG. 53.



On John Smallwood's land on Dorton creek of Shelby creek, and about 300 feet up the hill, the coal shown in Fig. 54 was measured.

Shelby creek and its branches, Dorton creek and Caney Fork, head in against the ridge dividing the Shelby waters from Elkhorn creek. This ridge on the Elkhorn side holds the famous Elkhorn coal in broad areas and great thickness, and forms a part of the territory known as the Elkhorn coal field. There is

no question as to the extension of the Elkhorn coal through this ridge for many miles to the north into the Shelby basin.

Passing up the river from the mouth of Shelby creek to the Elkhorn creek, a branch of Russel Fork, we pass the mouths of Greasy creek, Marrowbone creek, Pond creek and Moores branch, the principal streams that drain the triangular-shaped area between Shelby creek, Elkhorn creek and the river.



Much of this area has been thoroughly prospected in past years, and large tracts of it are now owned by companies who are awaiting transportation facilities to enable them to open mines and establish coking plants.

The old prospect openings are now fallen in so that no measurements could be obtained without much labor and time; but

the fact that the land was purchased and is still held by persons who caused a thorough examination to be made shows that these are valuable coal lands.

Dickman's report gives the section shown in Fig. 55 of a coal on Sycamore Fork of Marrowbone creek and the following analysis of the same:

ANALYSIS.

Moisture	0.84
Volatile matter	41.87
Fixed carbon	52.15
Ash	5.12
Sulphur	1.86
Phosphorus .....	.011

No openings were found on Marrowbone at this time, but reports that seemed reliable were had of three workable coals in the hills located as follows:

At about 700 feet above the stream a 6-foot coal.

At about 300 feet above the stream a 4-foot 4-inch coal.

At about 100 feet above the stream a 4-foot coal.

None of these were seen.

Reports of good coals were also heard on Greasy creek, Pond creek and Jess branch.

Analyses of Pike county coals taken from the Kentucky Geological Survey Chemical Report, Vol. A, part 2, pp. 228 and 303:

A. Coal from Stone Coal creek, $4\frac{1}{2}$ miles below Pikeville. Sample from upper 2 feet 8 inches.

B. Coal from same place as A, but taken from lower 3 feet of vein.

C. Coal from the head of Chloe creek, $2\frac{1}{2}$ miles south of Pikeville. Average sample from the lower 4 feet 8 inches.

D. Coal from Big Rock Hollow, of Bear Fork, of Robinson creek, of Shelby creek, 40 or 50 feet above the 32-inch coal. Section of coal is: Top bench of 27 inches, clay parting of 9 inches, bottom bench of 25 inches. Sample from top bench.

E. Coal from bottom bench of same bank as D.

F. Coal from 32-inch seam mentioned in description of D.

G. Cannel coal from Widow May's land on Bear Fork of Robinson creek. Sample from 32-inch bed of cannel coal. (See Fig. 46.)

H. Coal from William Hall's bank on the left-hand fork of Indian creek, about 4½ miles above where it flows into Shelby creek. Seam with sandstone roof and 48 inches thick.

I. Coal from Jackson Newson's bank on Robinson creek, 7 miles above where it flows into Shelby creek and 19 miles from Pikeville. Section of seam is sandstone roof, top bench 15 inches, parting of 7 inches, middle bench of 5½ inches, parting 1½ inches to nothing, bottom bench of 24 inches. Sample includes all three benches, but not the partings. Splint coal.

	A	B	C	D	E	F	G	H	I
Moisture	2.20	2.40	1.40	0.40	0.40	1.60	2.	0.60	1.
Volatile matter	36.10	35.40	33.66	33.20	34.80	30.80	43.40	33.94	34.20
Fixed carbon	58.10	58.26	58.60	62.46	60.46	62.80	46.30	59.46	58.90
Ash	3.60	3.94	6.34	3.94	4.34	4.80	8.30	6.	5.90
Sulphur .....	.651	.692	.825	.642	.711	.555	.689	.876	.903
Specific gravity	1.279	1.293	1.273	1.294	1.273	1.310	1.293	1.294	1.311

THE ELKHORN COAL FIELD.

Elkhorn creek or river, as it is sometimes called, is a large stream flowing from Pound Gap in a northeasterly direction along the foot of Pine Mountain for a distance of over 20 miles, and emptying into Russel Fork of the Levisa Fork of Big Sandy river. The stream is parallel to and at no place more than 2 miles distant from the State line between Kentucky and Virginia, which here follows the crest of Pine Mountain. The drainage area of Elkhorn creek is all in Kentucky and all in Pike county, except about 20 square miles around the head of the creek, which is in Letcher county, Ky., and which will here be described with Pike county.

The Elkhorn coal has probably attracted more attention than any other coal of the Big Sandy Valley, with the possible exception of the Johnson county cannel coals. It has been studied by the geologists of the Kentucky Geological Survey, and their work is embodied in the report of that survey. The coal field has also been visited by many coal experts and geologists in the interest of private parties and companies who had purchased or were contemplating the purchase of tracts of coal lands.

The district has been quite well prospected, considering its distance from railroads, general inaccessibility, rough topography and objectionable reputation that has unfortunately been attributed to its most hospitable inhabitants. The coal has been thoroughly tested as to its coking qualities by both small and large samples sent to coking plants, and by open piles at the place where dug. The coal is generally accepted as a fine coking coal, and its reputation and value is based upon this property.

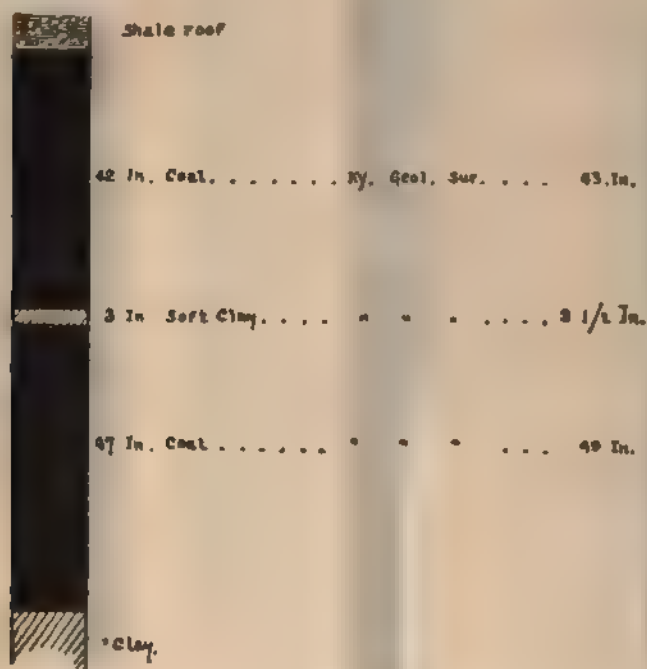
Large tracts of land in this valley are now held by companies who are waiting for a means of transportation to enable them to open large mines and coking works. The coal on the head of the creek can best reach the river by a short railroad through Shelby Gap and down Shelby creek to the river.

The Kentucky Geological Survey report on the Pound Gap region says that this coal is "probably the most important in the Pound Gap region, better known on Elkhorn creek, in Pike county, than elsewhere. In the Big Stone Gap region, in Virginia, this bed is known as the Imboden seam. It is also known as the 'coking coal' of that region, a designation which is applicable in the Pound Gap region from the coking qualities of the coal, as will be seen from such preliminary tests as have already been made. The area of the Elkhorn coal in its recognized character includes, in a general way, the head waters of Elkhorn and Shelby creeks, in Pike county; of Beaver creek, in Floyd county and Knott county, and portions of the head of the Kentucky river." Beginning at the head of Elkhorn creek, in Letcher county, and just under Pound Gap, sections and analyses of the coal will

be given in order toward the mouth of the creek. The sections are from my own measurements, the Kentucky Geological Reports, and special reports at hand. The analyses are from the various reports entirely, as circumstances did not permit having any analyses made at this time.

On H. H. Nochol's land, near the head of Elkhorn creek, in Letcher county, at an opening known as the "Mullins" bank, the section in Fig. 56 was measured at creek level. The Kentucky Geological Survey gives the same coal as in Fig. 56, and the following analysis of it:

Fig 56.



ANALYSIS.

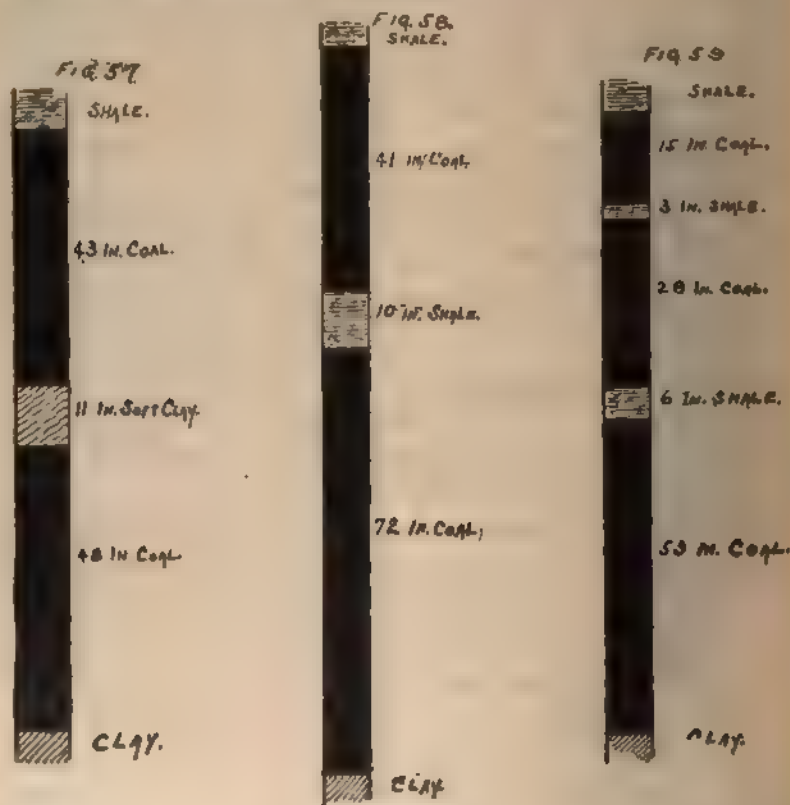
Moisture	2.60
Volatile matter	34.20
Fixed carbon	60.80
Ash	2.40
Sulphur . . . . .	.412
Specific gravity	1.282

On Alec Isam's land, on the west side of Elkhorn creek, between Peaks branch and Joes branch, in Letcher county, and about 80 feet above the creek, the section in Fig. 57 was measured.

On Peaks branch of Elkhorn, in Letcher county, the Kentucky Geological Survey gives the section as shown in Fig. 58.

On the left fork of Marshalls branch of Elkhorn, Letcher county, the Kentucky Geological Survey gives the section in Fig. 59.

On the main part of Marshalls branch of Elkhorn creek, on the land of George Adams, Dickman's report gives the section in Fig. 60 and the following analysis:



ANALYSIS.

Moisture	1.24
Volatile matter	38.84
Fixed carbon	58.65
Ash	1.26
Sulphur	.64
Phosphorus	.004

The Kentucky Geological Survey gives the section in Fig. 61 as from the right fork of Marshall's branch, Pike county, and the section in Fig. 62 as from Cane branch of Elkhorn, just east of Shelby Gap, and the following analyses of the two benches of the Cane branch coal:

Fig. 60

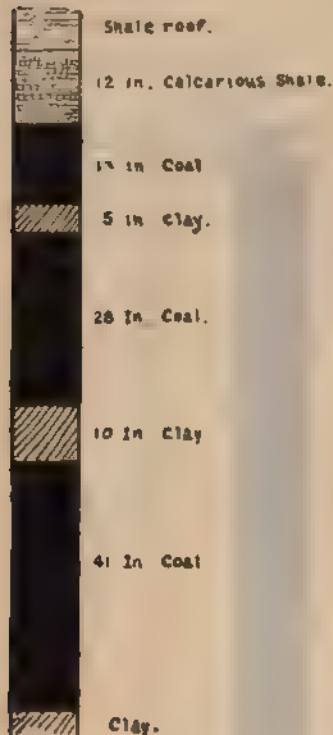
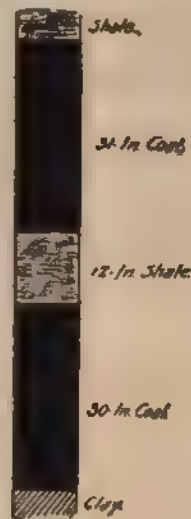


Fig. 61 On Marshall's Branch



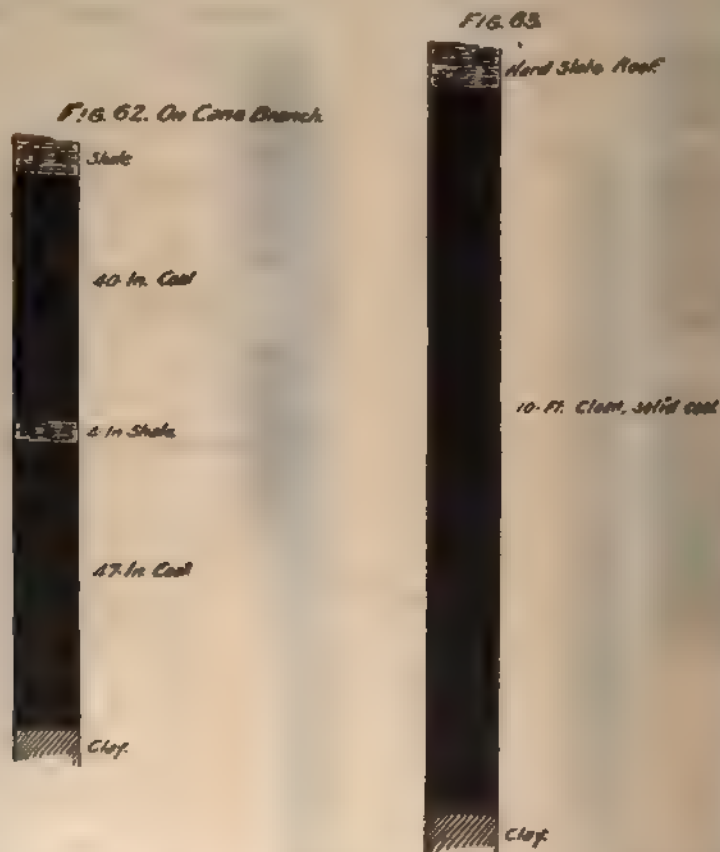
ANALYSES OF CANE BRANCH COAL.

	Upper	Lower
Moisture	6.	2.54
Volatile matter	31.26	32.26
Fixed carbon	59.34	62.20
Ash	3.40	3.
Sulphur .....	.390	.547

One mile up Pigeonroost branch of Elkhorn creek Dickman's report gives the section in Fig. 63 as being at the creek level.

He also gives the following analysis of the coal:

Moisture	1.06
Volatile matter	37.91
Fixed carbon	58.79
Ash	2.23
Sulphur .....	.76
Phosphorus .....	.004



On Sycamore branch of Elkhorn creek a coal is opened about 100 feet above the creek level that is reported to be 10 feet thick, but the opening was so obstructed that a complete section could not be made at present. Nearly 7 feet of clean, solid coal, with

no partings, was exposed and measured, but the bottom was covered with water and debris.

The Kentucky Geological Survey shows the section in Fig. 64 as from Ben branch of Elkhorn creek, Pike county, and the section in Fig. 65 as being on Benjamin Potter's land.

On a small branch on the east side of Elkhorn creek, just opposite the mouth of Ash Camp creek and along the trail going over Ash Camp in Pine Mountain, the coal is opened at 300 feet above the stream. It has a strong local dip of about 9 per cent. to the northwest, and the coal and roof is badly crushed, broken, and twisted, showing the effects of the great movements that took place at the formation of Pine Mountain.

Dickman's report gives the section shown in Fig. 66 as belonging to this opening and the following analyses of the coal. When this bank was visited only 7 feet of coal, without partings, was exposed above the water in the mines. No doubt the measure given by Dickman is correct.

ANALYSIS.

	Coal	Coke
Moisture	0.60	0.16
Volatile matter	39.22	.10
Fixed carbon	58.	92.46
Ash	2.16	7.46
Sulphur .....	.90	.581
Phosphorus .....	.005	.008

Following are analyses of Pike county coals taken from Kentucky Geological Survey Chemical Report, Vol. A, part 2, p. 225:

ELKHORN COALS.

A. On Big Elkhorn. Seven feet bed with a 2-inch parting 6 inches above the middle. Average of whole bed.

B. From Isaac Patton's new bed on branch, head of Elkhorn creek. Two feet thick or more.

C. On big Elkhorn creek at Mullens branch, head of Kentucky river. Bed nearly 4 feet thick. Average sample of lower part.

D. Rice's coal on Mill branch of Elkhorn creek. Whole thickness, 101 inches. This sample from lower 44 inches.



E. From same bed as D, but from upper part of bed.

F. Coke made from Rice's coal, same bed as samples D and E.

G. Coke made of the Elkhorn coal in an oven in Cincinnati, Ohio.

H. Slack coal from Elkhorn creek for coking test at Connellsville, Pa.

I. Coke made from H at Connellsville, Pa., by inclosing the

coal in a wooden box, nailed up and putting it in the midst of the Connellsville coal in a coking oven.

J. Coal from Cane branch of Elkhorn creek. Sample from the upper 5 feet 5½ inches above the 6-inch parting.

K. Coal from same bed as J. Sample from the lower 3 feet 7 inches.

L. Coke from coal taken from upper part of seam from William Mullen's bank on Elkhorn creek.

M. Coke made from mixed samples of coal from same bank as L. It is probable that samples L and M are from the same bank as sample C.

	A	B	C	D	E	F	G
Moisture	2.60	2.60	2.	1.60	1.60	2.86	0.20
Volatile matter	34.20	33.40	33.50	32.10	29.36	.....	.....
Fixed carbon	60.80	61.80	60.54	64.64	67.40	88.44	93.20
Ash	2.40	2.70	3.96	1.66	1.64	8.70	6.60
Sulphur .....	.412	.467	.429	.711	.610	.844	.734
Specific gravity	1.282	1.307	1.271	1.278	1.271	.....	.....
	H	I	J	K	L	M	
Moisture	1.80	1.20	6.	2.54	1.10	1.06	
Volatile matter..	26.80	....	31.26	32.26	....	.....
Fixed carbon ...	67.60	94.14	59.34	62.20	95.40	90.40	
Ash	3.80	4.66	3.40	3.	3.50	8.54	
Sulphur .....	.967	1.484	.390	.547	.517	.598	
Specific gravity .	.....	.957	1.355	1.314	.....	.....

On Ash Camp creek coal has been opened and found to be of good thickness, but could not now be measured. From Ash Camp to the mouth of Elkhorn no openings were seen nor are any sections at hand from other reports. Local reports that seemed

to be reliable stated that the coal maintained its thickness and quality to the river, but was there high in the mountains.

Prof. John R. Procter, former director of the Kentucky Geological Survey, gives the following general section of the coal measures as applying to the Elkhorn region:

Coal No. 7: Eighty inches thick. Interval from 275 to 350 feet.

Coal No. 6: Robinson creek coal of Pike county. A thick coal. Interval from 150 to 175 feet.

Coal No. 5: "Upper splint," 36 to 80 inches thick. Frequently a cannel coal. Interval from 100 to 150 feet.

Coal No. 4: "Lower splint," 36 to 83 inches thick. Frequently a cannel coal. Interval from 130 to 175 feet.

Coal No. 3: Elkhorn coal or main coking coal, 63 to 96 inches thick. Interval from 70 to 120 feet.

Coal No. 1: Coal from 36 to 60 inches thick.

Professor Procter also says in regard to certain lands of about 50,000 acres in the Elkhorn coal field:

"No. 3 being near the base of the hill underlies the greater portion, excepting the slight area removed by erosion, and as the hills are high enough to include most of the section (given above) and in places all of the section, it would be a safe estimate to assume that three-fourths of the property will include all of the coals, including No. 7. The Kentucky Geological Survey has demonstrated the fact that as many as eight beds of coal of good thickness are found above drainage in Pike county; that several of these coals are unexcelled by any because of purity, thickness and cheapness of mining. From one of these beds (named the Elkhorn seam) a coke superior to the Connellsville composition and equal in strength and physical structure, can be produced."

QUANTITY OF COAL IN PIKE AND LETCHER COUNTIES DRAINED BY THE
LEVISA FORK.

The area of Pike county drained by the Levisa Fork, is about 567 square miles. To this will be added 20 square miles in Letcher county, making a total area of 587 square miles.

There are few parts of this area that do not hold at least one workable coal of good thickness in its hills and in many places three are known over wide areas.

It is thought that it will be very conservative to estimate one-third of the total area as holding 6 feet of clean merchantable coal that can be mined and shipped. This estimate gives the following: 587 square miles by 13 by 6 feet by 640,000 tons, or 751,360,000 tons.

BASIN OF RUSSEL AND LEVISA FORK IN VIRGINIA.

The Levisa Fork and its main branch, Russel Fork, extends into Virginia and drains an area of about 833 square miles located in the counties of Wise, Dickenson and Buchanan. This area is mountainous, heavily wooded, thinly populated, and not reached by railroads.

While this district is above the contemplated slack-water navigation improvement it was desired that something be learned of its minerals. A hasty tour was therefore made through the northern part of Dickenson county and the western part of Buchanan county to gather such information as was available. As a rule the people have given no thought to such matters, and very little is locally known as to the thickness and extent or number of coal seams in the district and nothing at all as to the iron ores and clays, nor has there been any prospecting for minerals by outside parties, as has been done in Kentucky and West Virginia.

In many neighborhoods a coal would be opened where the local blacksmith and a few families would get their fuel. In some places two seams would be known and opened. The coals seen ranged in thickness from 3 to 6 feet and some of them were fine bituminous coal. A few large coal blossoms were seen in the hill roads and trails, but time could not be taken to investigate them as to thickness.

It is safe, I think, to predict that there are large areas of workable coal in this district which will be found and mined in a large

way for the general markets some time in the future. Just across the dividing line to the southeast of these streams are at present large mines that ship a large output by railroad.

No attempt has been made to make an estimate of the coal of this district, principally because it is too far above the proposed river improvement, and secondly, because of the meager data for such an estimate.

SUMMARY OF QUANTITY OF COAL ON THE LEVISA FORK.

Gathering the estimates made for the various counties, we have an estimate of the number of tons of coal that may be expected to come down the Levisa Fork Valley before that coal field is exhausted:

	Tons.
Lawrence County	55,296,000
Johnson County	419,840,000
Floyd County	256,000,000
Knott County	64,000,000
Pike County	751,360,000
Letcher County	
Total	1,546,496,000

This number is so vast that one can not grasp its meaning without some kind of comparison. For this purpose the following few statistics have been gathered from the most convenient sources.

From the Report of the Inspector of Mines of Ohio for 1896, the following is taken:

Amount of coal (including anthracite) shipped up the Great Lakes from Ohio, Pennsylvania, Maryland and West Virginia:

	Tons.
During 1890	5,200,449
During 1891	6,016,331
During 1892	7,596,812
During 1893	7,773,580
During 1894	6,869,257
During 1895	7,318,234
During 1896	8,914,327
Average of the seven years	7,098,429

If we assume that this trade has or will grow to, say, 10,000,000 tons per year, we see that the Levisa Fork has enough coal to supply the entire lake trade for over one hundred and fifty years.

From the Report of the Chief Engineers for 1895, p. 2091, Maj. W. H. Heuer gives the following as the total shipment of coal from Pittsburg, Pa., down the Ohio river in boats and barges:

	Tons.
During 1886	3,483,232
During 1887	2,155,702
During 1888	4,174,376
During 1889	2,589,639
During 1890	3,420,357
During 1891	2,893,752
During 1892	2,299,294
During 1893	2,364,401
During 1894	2,453,787
During 1895	2,393,873
Average of the ten years	2,822,841

If we assume the coal shipped on the river from Pittsburg to be 6,000,000 tons per year, we see that the Levisa Fork could supply this trade for over two hundred years.

If it should be thought that the estimates given for the various counties are too large, it is seen that they may be reduced by a large per cent. and still show an enormous quantity of coal in this valley. It is believed that those best acquainted with the valley will criticise this report because the estimates are made as small as they are, but it is thought best to err on this side.

TUG FORK.

Tug Fork of the Big Sandy river drains an area of about 1,600 square miles located in the three States of Kentucky, Virginia, and West Virginia. Of this area about one-half may be considered as coal territory tributary to the proposed slack-water navigation improvement which is now proposed to extend a short way above Williamson, W. Va.

That portion of this tributary area located in West Virginia is now mostly within reach of the Norfolk & Western railroad, which follows the east bank of the river from Naugatuck, at the mouth of Pigeon creek, to its head. The portion in Kentucky can

also be reached from this railroad, but expensive bridges would be required to cross the river for each branch road, which will delay the development of this territory.

The detailed description of the area and the estimates of the quantities of coal will be taken up by counties, as on the Levisa Fork.

LAWRENCE COUNTY, KY.

This county does not hold any coals of importance in the portion drained by the Tug Fork. There are local reports of several small coals along the river, but none were opened so that measurements could be made of them. Judging from the coals on the Levisa Fork, and taking the dip into consideration, none of the best coals are to be expected on the Tug Fork. There may be local thickenings of the thin veins which may pay to work in a large way, but none are now known.

No estimate will be made of the coal that may be obtained from this county.

WAYNE COUNTY, W. VA.

The quantity and quality of the coal in this county is very little better than in the last county described. The southern and eastern parts of the county have some coal of value and adjoin good coal territory of other counties. The extreme southern end of the county reaches to Sand Bar Bend of the river, where the Warfield coal disappears under the river to the north. It is probable that a considerable area of the Warfield coal can be reached by shaft in the southern end of the county.

Jennies creek heads with Marrowbone creek of Mingo county against the waters of Twelve Pole creek. On both Marrowbone and Twelve Pole thick coals are known, which ought to be found on the waters of Jennies creek.

On account of the lack of data no estimate will be attempted for Wayne county, although it is very probable that the Warfield coal will be worked in a large way within its limits.

MARTIN COUNTY, KY.

This comparatively small county is all drained by the Tug Fork and mostly by two large creeks, branches of Tug—Wolf creek and Rock Castle creek.

In the northern end of the county the Peach Orchard coal has been located just across the ridge from the mines in Lawrence county. It is claimed that the thickness is the same as at the mines, but no openings were found where measurements could be made. For a section of the Peach Orchard coal see Figs. 4 and 5.

On Stafford Fork of Rockhouse Fork of Rock Castle creek and opposite the heads of White House and Greasy creeks the thick coal shown in Fig. 7 is found in the tops of the ridges and extends along the ridge to the south for several miles.

On the heads of Rockhouse Fork and Middle Fork of Rock Castle creek a very large tract of land has been held for several years by persons who made a thorough examination of the lands for coal. The E coal shown in Figs. 14 and 17 is on this tract and is considered the most valuable of the several coals found. The following section of the hills on this tract has been well established:

Coal No. F: From 11 to 12 feet thick. See Fig. 7. Interval, 135 feet.

Coal No. E: From 5 to 6 feet thick. See Figs. 14 and 17. Interval, 65 feet.

Coal No. D: From 9 to 11 feet thick. Full of thin clay partings and not counted of much value. Same as Peach Orchard seam. Interval, 85 feet.

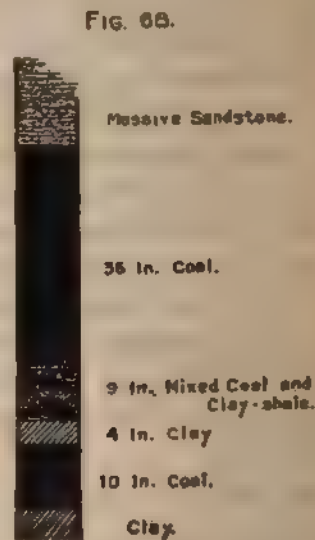
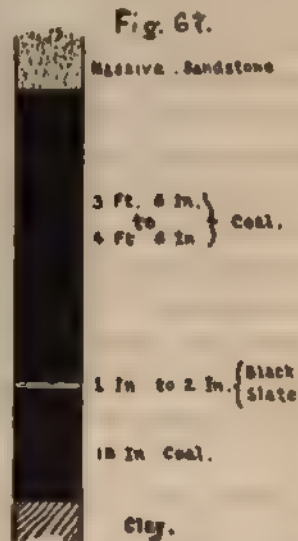
Coal No. C: Averages about 4 feet thick. Interval, 40 feet.

Coal No. B: Averages about 3 feet 6 inches thick. Interval, 75 feet.

Coal No. A: Averages about 4 feet 9 inches thick. At creek level on this tract and thought to be the No. 1 coal of the Kentucky Geological Survey, but not well determined, and some well-informed persons think that the No. 1 or Warfield coal is still below the No. A coal of this section.

The E coal is the most important and has been well prospected and proven to extend over a large area with its usual thickness and quality. The following analysis is from the owners of the lands:

Moisture ..	3.51
Volatile matter ..	31.36
Fixed carbon ..	56.30
Ash ..	8.80
Sulphur ..	5.65



Well-informed persons think that this E coal can be mined from at least 50 per cent. of the area included in a district 6 miles wide and 14 miles long in the western edge of Martin county. In the hills around Edentlnez post office, on Rock Castle creek, two coals are known, and one of about 4 feet thick is worked for the local supply.

WARFIELD COAL.

At the village of Warfield, on the Tug Fork, a fine seam of coal crops out very prominently at many places and has been mined in a small way for many years. At one time it was mined for the manufacture of salt and to supply the small steamboats on the river.

The coal is about 40 feet above the river bed at Warfield and dips both ways. Down stream it goes under the river at Sand Bar Bend, about 3 miles from Warfield, and upstream it goes under the river at the mouth of Wolf creek, about 2½ miles from Warfield.

It is found in or near the bed of Wolf creek for a few miles up that creek.

At Warfield it was measured as shown in Fig. 67.

The following analyses show the composition of the Warfield coal and another coal 150 feet above it:

A. Warfield coal.

B. Warfield coal.

C. A 42-inch coal 150 feet above the Warfield coal.

	A	B	C
Moisture	2.73	2.47	1.46
Volatile matter	34.78	34.18	32.60
Fixed carbon	59.18	55.03	62.68
Ash	3.07	8.32	3.26
Sulphur .....	.24	1.17	.....

WOLF CREEK.

This large creek drains a large basin that has not been so well prospected, so that neither the thickness nor extent of the coals is well known. The few openings and creditable reports that were noted showed that at least one good workable coal is found quite generally through this Wolf Creek Valley. From the reports this coal closely resembles the E coal of Rock Castle creek or a 5-foot coal on the head of Big creek of Pike county, Ky., and described below.

Going up Tug Fork above the mouth of Wolf creek reliable reports were heard of a coal ranging from 5 to 6 feet thick opposite Naugatuck, at the mouth of Pigeon creek, West Virginia. It is

probably the same as a coal found near Naugatuck on the West Virginia side of the river.

QUANTITY OF COAL IN MARTIN COUNTY.

The data for an estimate of the available coal of Martin county is not as abundant nor as definite as desirable, but it is thought that it is safe to say that at least one-fourth of the entire area of the county can be counted as holding 4 feet of coal that can be mined and shipped. This gives the following: Total area of 236 square miles by $\frac{1}{4}$ by 4 feet by 640,000 tons equals 151,040,000 tons.

PIKE COUNTY, KY.

[Northern part. Drained by the Tug Fork.]

This portion of Pike county is drained by the following large creeks, all tributaries of the Tug Fork: Beginning at the northern edge of the county and going to the Virginia line we pass the mouths of Big creek, Pond creek, Blackberry creek, Peter creek, and Knox creek; Knox creek also drains a large area in Virginia.

The high, broad ridge against which these creeks head and which divides the waters of the Levisa and Tug forks, together with the big ridges dividing the creeks one from another, have been fairly well prospected in the past. The prospect holes have now filled up so that very little can be learned by visiting them, so that most of the information regarding this region has been obtained from the citizens of the district and from the mining engineers and prospectors who examined the lands for coals. Large tracts of lands are now owned by companies that had these examinations made, which fact is a good indication of the presence of valuable deposits of coal.

The same big coal found on Feds creek (see Fig. 38), Big creek of Levisa Fork, and Lick creek of Levisa Fork (see Fig. 41) comes through the ridge in its full thickness, being from $5\frac{1}{2}$ to 7 feet thick on the heads of Peter creek, Blackberry creek and Pond creek. On the head of Road Fork of Big creek of Tug Fork, at an

elevation of about 300 feet above the creek, a large coal blossom was seen in the road, but no opening was found where it could be measured. It was reported to be from 5 to 7 feet thick. It was probably the blossom of the thick coal above referred to. At the creek level of the same Road Fork the coal shown in Fig. 68 was measured on Pinson's land.

On the ridges between and on either side of Blackberry and Peter creeks, the extension of the noted Thacker coal of West Virginia has been fully identified and found to be about 6 feet thick over a considerable area. The relation of the Thacker coal and the thick coal on the Levisa Fork side of the dividing ridge on Feds creek, Lick creek, etc., has not been worked out; they may be the same or there may be two of these large coals to be found in these hills.

In the same ridges where the Thacker coal has been identified on Blackberry and Peter creeks a 4-foot coal is found from 40 to 60 feet below the Thacker coal.

The Thacker coal and the 4-foot coal both lie low in the hills and cover a large percentage of the total area over a large district. On the head waters of Pond creek the thick coal is found with two others below it in the same hills. On Turkey creek, about 2 miles below Williamson, W. Va., is found a thick coal full of thin partings and with 21 inches of cannel coal in it, at 340 feet above the creek. The same cannel coal is also found on Long Fork or Big creek of Tug Fork. On Frog Pond branch, a small creek between Turkey creek and Big creek, three workable coals are found, one being near the creek level.

QUANTITY OF COAL IN PIKE COUNTY, KY.

[On the Tug Fork Watershed.]

From all information that could be gathered, it seems conservative to estimate 40 per cent. of the total area as holding 5 feet of coal that can be mined and shipped. The area of Pike county drained by Tug Fork is 226 square miles. The amount of coal is then

226 square miles by 0.40 by 5 feet by 640,000 tons, or 289,280,000 tons.

[Here Prof. Brown gives descriptions of coals in Mingo county, W. Va., tributary to Tug Fork, and especially of the Thacker coal field. It is not deemed necessary to include that part of his report.—C. J. N.]

Quantity of Coal in the Tug Fork Valley Tributary to the Proposed River Improvement.

	Tons.
Lawrence County, Ky.	Not estimated.
Wayne County, W. Va.	Not estimated.
Martin County, Ky.	151,040,000
Pike County, Ky. (northern part)	289,280,000
Mingo County, W. Va.	230,400,000
Total	670,720,000

Stating this quantity in the same units as used for the Levisa Fork, we see that the Tug Fork could maintain the coal trade up the Great Lakes for sixty-seven years, or could maintain the Pittsburgh shipments on the river for over one hundred years.

Summary of Quantity of Coal on the Two Main Forks of the Big Sandy River Tributary to the Proposed Improvements.

	Tons.
On Levisa Fork	1,546,496,000
On Tug Fork	670,720,000
Total	2,217,216,000

This quantity is so great that it may be thought that the estimates have been too liberal, but if it be discounted even 50 per cent. there is still left a quantity almost beyond conception. But it is thought that the estimates have been quite conservative and that the quantity of available coal in these valleys is much more than above stated.

The estimate of 1,000 tons of coal for each acre of coal 1 foot thick is at least 20 per cent. below what is now obtained in many coal fields, and it is probably 25 per cent. below what can be obtained with the best modern methods of mining.

The estimates of acreage and thickness of seams is much less than what is claimed by many persons thoroughly acquainted with the field, some of whom are not in any way interested in its development.

XV.**REPORTS ON EASTERN COAL FIELD.**

The following reports on parts of the Eastern Coal Field are reprints of publications issued by the State Geological Survey during the term of Hon. John R. Procter as Director. Leading title-pages and letters of transmittal are omitted solely for the purpose of limiting the bulk of this report as much as possible. The reports are printed from stereotype plates, hence the cost of reproduction is only that of paper and presswork. The first report, on the "Pound Gap Region," is by Prof. A. R. Crandall; the second and third reports, on the geology of the counties drained by the Three Forks of the Kentucky river are by Mr. J. M. Hodge. These reports, combined with Prof. Brown's report on the Big Sandy, together with notes on the Southeastern District in chapter XII of this report, give a fairly good general notion of the Eastern Field. It is to be observed, however, that they are all "preliminary" in nature, and are subject to such revisions as may be indicated by developments which have been made since the field work upon which they were based was done.

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REPORT ON THE POUND GAP REGION.

The mineral resources of the upper counties are represented chiefly by the beds of coal which, to the number of from six to eight, are found in workable thickness. Enough is now known of this region to warrant the statement that nature has made ample compensation for remoteness from established lines of traffic in both the quality and the quantity of the coal deposits. This will be seen from the sections and analyses accompanying this report. On the other hand, a report on the iron ores must be disappointing, so far as any expectation of large deposits in the coal measures may have been indulged. (See Introduction, page 3.) Reports on the lower counties show an increased leanness in iron ore deposits towards the headwaters of both the Kentucky and the Chattarawha or Big Sandy Rivers. So far as known Pike and Letcher counties are no exception to this tendency, excepting only a narrow belt on the face of Pine Mountain, where, along an extended fault line, ore bearing rocks below the coal measures are brought to the surface. These ores will be described in the proper connection.

TOPOGRAPHY.

The Pound Gap region presents some topographical features which in the lower counties are entirely wanting. These features are the accompanying results of the violent movement attending the formation of the fault-ridge known as Pine Mountain.

So bold an escarpment, extending for nearly one hundred and forty miles across the country, could not fail to give to the adjacent topography many characteristics, of which the mountain itself is the best exponent.

The greater elevation of this mountain barrier, and the abruptness of its face, formed by uplifted rocks along an extended line of fracture, appears at first approach more like an interruption of the topography of the country by the uplifting of a barrier across it after its hills and valleys had been carved out and its drainage established, than like a part of the general result of the erosion of the whole country after the formation of this fault-ridge. Doubtless there is a considerable margin of fact on the side of this first impression, as will be seen by a comparison with the Cumberland mountain. But the time of the formation of this fault-ridge is probably so little removed, comparatively speaking, from the time of the upheaval of the coal measures as a whole to form a permanent part of the continent that it may at least be regarded as a prominent factor in the determination of the drainage before the river systems of to-day were mapped out around it.

From the time of the uplift to the present, Pine mountain has not been less prominent as a mountain barrier than it is to-day. And the drainage of this region has adjusted itself to this prominent feature, making extended detours along the foot of the mountain slope to find outlets to the westward with the general slope of the country. Along the face of the mountain, also, the valleys have fallen into line with the fault, as in the instance of Elkhorn Creek, of the Kentucky River above Whitesburg, and of the heads of the streams in the southwestern part of Letcher county, the same parallelism continues along the whole face. Away to the westward and north the drainage conforms in general to the slight inclinations of the rocks of the coal measures, which illustrate by varying dips, some of the minor movements attending mountain-making.

Pound Gap is at the head of important branches of two great rivers, the Kentucky and the Chattarawha or Big Sandy, which flow in widely different directions, in consequence of the slight, but well defined anticlinal, which extends from the Gap westward. (See on accompanying map the direction of inclination as indicated by arrows.) For this reason Pound Gap, though only cut deep enough for a tolerably good wagon road, is an important point in this long mountain barrier. With the development of railway systems to the East and South, it will become

a more important point of convergence, especially from the valleys of the Kentucky and the Licking rivers, which have for a separating watershed the extension of the Pound Gap anticlinal, as above described.

Pine mountain* extends as a fault-ridge from the Breaks of Sandy, in a general southwest direction, to the Elk Gap, in Tennessee, with but two water gaps in the intervening distance, or three in all, including the Breaks. The relation of Pine mountain to the Black and Cumberland mountains, to the southeast, gives additional importance to Pound Gap, as a possible outlet in that direction. The average height of Pine mountain above the drainage on the northwest is, in Pike and Letcher counties, about 1,600 feet. The southeast slope is about 200 feet less. Some notion of the prominence of this ridge is given by the view up the Kentucky river from Whitesburg. (See Plate A.) Also the view at the mouth of Elkhorn creek.

The termination of the Pine mountain fault, at the Breaks of Sandy, gives to the northeast of this ridge the character of an anticlinal, of no great prominence in the general topography of the region, but still an uplift sufficient to place the upper portion of the conglomerate formation above the drainage, and so to give to the country along its axis the peculiar cliff and gorge topography of this formation. In this character it extends across the country to the Tug Fork of the Big Sandy river, and into West Virginia.

The rocks exposed in the Breaks are all of the conglomerate formation at the base of the coal-measures, and there is shown, by comparatively slight displacements, little of the effects of the profound fault, which, within three miles to the southwest, represents a displacement of not less than 2,000 feet.

*From the Breaks of Sandy to the Pound Gap or Sounding Gap, as it is sometimes called, the Pine Mountain is known by many as the Cumberland Mountain. This is but one of the instances of confusion arising from local nomenclature. The two ridges, the Pine and the Cumberland, are joined near the Pound Gap by a Black Mountain ridge, separating the waters of the Pound Fork of the Sandy river and the Powell river on the one side from the Cumberland waters on the other. Along this ridge the State line crosses from the Cumberland to the Pine Mountain, but the distinction in both the geology and topography of the several ridges is fully preserved, the Pine Mountain having a westward and the Cumberland an eastward escarpment throughout.

With equal confusion of the geography of the country the northeast extension of the Cumberland mountain is called the Stone mountain.

With the introduction of accurate topographical maps, it may be hoped that correct notions of the geography of this region will prevail.

Little time has been found to study in detail the effects of this sudden change from an anticlinal to a fault-ridge, or the conditions attending the formation of the water-gap at this transition point. The northwest dip of the anticlinal extension of the mountain beyond the Breaks is preserved to some extent along the face of the fault-ridge southward, giving a considerable area along Elkhorn creek and to the west, in which the conglomerate formation and the comparatively barren shales above form the bases of the hills. The fall of the Elkhorn and Shelby creeks is such that these rocks rapidly fall below the drainage towards the headwaters. (See sections, Plate IV.) The moderate dips, westward from the Breaks, do not fully account for the sudden disappearance of the massive conglomerates which form the walls of the Breaks, as noted along the Russell Fork. No fault has been observed crossing the gorge; but it is probable that one exists for some distance north of the Breaks, but to the westward of the line of the main fault.

The Breaks of Sandy, though now almost inaccessible, will, with the advantages of railway transportation, become a point of great interest as an unusually attractive mountain gorge. Plate B. shows something of the character of the Breaks below the towers, which rise to a height of nearly 1400 feet above the river.

The geology of Pine mountain is not complicated by any considerable variation from the simple fault-ridge type of mountain. The average dislocation, by the upthrow of the whole series of rocks, to an unknown depth along the fault line, is about 3000 feet. The rocks exposed in the face of the mountain reach downward and backward in time to the Upper Silurian formation. These lower rocks offer little of economic value for the present, except the iron ores, which will be noticed in their proper place. But they offer important testimony relating to the history of Pine mountain. The formations represented are in the same order as noted along the outcrop of the coal measures. (See report of Lesley on western outcrop of the coal measures, Vol. IV, old series; also report on the geology of Menifee county, Part 4, Vol. C, new series, and other reports by the writer.)

The following table shows approximately the thickness of the several formations :

Western Outcrop.		Pine Mt. Region.
Upper Silurian rocks, 100 to 200 feet.....		400 feet.
Devonian (black shales) 65 to 120 feet.....		150 feet.
Lower Carb. {	Waverly Gr., 300 to 600 feet.....	200 feet.
	Sub-Carb. Limestone, 20 to 400 feet.....	500 feet.
Carb. Congl. Sandstone, 10 to 300 feet.....		2000 feet.
Measures above the Congl.*.....		2300 feet.

It is interesting to note the changes in thickness as indicated by this tabular view. Up to the beginning of the Carboniferous proper there is nothing along the mountain axis, as now known, to distinguish it from the wide stretch of rock-forming area on either side ; certainly not to the northwest. The thickness of the Sub-Carboniferous Limestone to the east and south is important as indicating a northwest limit to this area, and also as representing in retreat from this limit a long continued period of comparative freedom from most of the disturbing conditions which interfere with the life of a moderately deep sea.

During the formation of the Upper Carboniferous series, the limit of this area appears to have been little changed. But the conditions attending the distribution of rock-material was so modified, and the deposits so accelerated along a subsiding axis, that there begins from the first a distinct history of the belt, which with the subsequent upheaval, and with the ages of erosion which have followed, is now represented by the mountains upon the southeast border of Kentucky.

It is understood that the great thickness of rocks along mountain ranges is no mere coincidence ; but, on the other hand, that the great accumulation of rock material upon the sea floor along an extended axis, carries with it the antecedent conditions for mountain making. These mountains are, therefore, as indicated by this tabular view, Carboniferous in a wider sense than is comprehended in the mere time of final upheaval to form a part of the continent. Pine Mountain as a fault-ridge, must, however, be regarded as having its origin later than the Carboniferous Age.

*The original thickness of these rocks at the present outcrop would be the thickness that has been worn away, as also the original thickness in the Pine Mountain region would be 2300 feet with the thickness removed by erosion added. No reliable estimate of extent of the erosion in either locality can be made as yet. It is probable that it has been greater along the border of the coal-fields, but not enough to indicate an approach to the thickness in the upper country.

The first stage in the history of these mountains was also a part of the history of a wide and shallow channel of the sea as formed by the older mountains of North Carolina on the one side, and by the Kentucky Anticlinal of the Silurian Age, extending through what is now Central Kentucky, on the other.

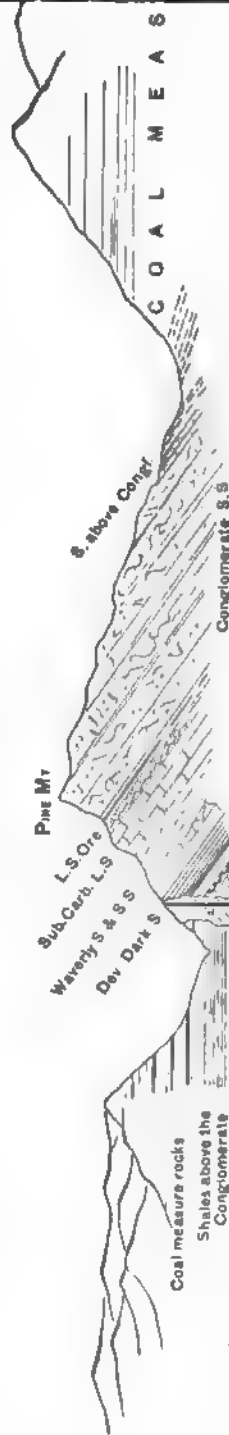
This is not the place to discuss the actual limit of the Carboniferous deposits westward, or the possible connection of the Eastern with the Western coal-fields across the Bluegrass region by coal-bearing rocks, which may subsequently have been worn away. That which is of importance in this connection, is the fact that to the northwest, as also probably to the southeast, from the line of thickest deposits and of the greatest successive subsidences, these movements and these deposits were evidently less and less towards an axis of little movement and of minimum deposits during this part of the history of the coal-measures. This, with the ordinary variation of conditions over so wide an area, will serve to explain the want of similarity between the sections in the lower counties and those of the Pine mountain region. It is not unlikely that, conforming to the shortest distance to the southeast sea shore, a much more rapid thinning out should be assumed to have facilitated the wearing away of the whole Carboniferous series beyond the crest of the present Cumberland mountains.

The accompanying profile section of the Pine, the Black and the Cumberland mountains show the order of geological formations in these mountains, and for the Pine mountain substantially the relation of beds to the drainage throughout its length. There is also shown some interesting facts in the later history of these mountains. Whatever the fact may be as to the axis of these mountains, as indicated by the line of the greatest Carb. deposits, it is evident that the Cumberland mountain represents the line of final uplift, so far as it is now represented by Carboniferous rocks.*

But the crest of the Cumberland mountain has been carried back several miles from this line of upheaval, while the Pine Mountain has receded but a little from the fault-line which

*There are some reasons for supposing that this anticlinal, along which in this region only Silurian rocks are now exposed, has an earlier origin than the close of the Carboniferous Age. This is not, however, the place to discuss this point, it being in no way essential to the purpose of this report.

Profile Section of the Pine, Black and Cumberland Mts. (Diagrammatic)
 Dip greatly exaggerated.



BLACK MOUNTAIN

ROCKS ABOVE THE CONGLOMERATE SANDSTONE



marks the starting-point as a receding crest. Hence this fault-ridge has been described as of much more recent origin than the Cumberland anticlinal.*

But the great contrast in these receding escarpments should not alone determine the comparative lateness of the formation of the fault-ridge. The synclinal slopes of these mountains show about an equal progress of the wearing agencies. The general inclination of the rock-beds being about the same in both mountains (15 to 25 degrees), or, if there is any difference in dip favoring erosion, it is with the Cumberland slope. This fact should greatly qualify the inference drawn from this striking contrast in the two receding crests. The truth lies between these conflicting records. And whichever indication may be regarded as most important, the harmonizing of the two must be regarded as emphasizing very greatly the effects of varying exposure to the sun. The face of Cumberland mountain and the slope of the Pine are fully exposed to the direct rays of the sun, while the slope of the Cumberland and the face of Pine mountain present northward exposures. It is, doubtless, very largely owing to this that the very great inequality in the retreat of the two crests is set over against the equal erosion of the synclinal slopes. The erosion of the receding wall of the Cumberland and of the Pine mountain slope has been greatly accelerated by more frequent and more effective alternations of sunshine and frost. The same effect is prominent in the valleys along the fault line of the latter mountain. These valleys are to the northward instead of to the southward of the fault line, as should have been expected from the well-known acceleration of erosion with increased dips, other conditions being equal.

It still remains that the Pine mountain fault is considerably later in time than the Cumberland uplift. It is undoubtedly a sequence to the general movement attending the formation of the latter mountain.

THE IRON ORE OF PINE MOUNTAIN.

As indicated by the accompanying profile section, two regular iron ore horizons are brought above the drainage by the

*Prof. N. S. Shaler, Vol. III, New Series, p. 224; also report on the region adjacent to the Kentucky and Virginia State-line, by P. N. Moors, Part 4, Vol. IV, New Series.

Pine mountain uplift; the same that are exposed by the cutting away of the overlying rocks along the front of the Cumberland mountain. The Limestone ore of the profile section is the same as the Red River ore, which falls below the drainage in the western border counties of this coal-field. (See report on the Red River Iron district, report on the Iron ores of Greenup, etc., also report on the Geology of Menifee, Vol. C., reports on the Eastern coal-field.) Not much is known of the thickness and persistency of this ore in the Pound Gap region, as it is usually covered by the soil and mingled fragments of rock, which cover the face of the mountain to a considerable depth. It is seen at many points in a weathered state upon the surface, sometimes, as at the heads of Pigeon-roost Br. and of Toms Br. of Elkhorn creek, in a spur of Pine mountain it is exposed in great profusion over the surface.

The quality of the ore is not inferior to that of Estill and Menifee counties. Whether it is thick enough for profitable mining, dipping as it does into the face of the hill, is a question to be settled by practical tests. The surface indications are favorable, but could not be held as conclusive except as to the equivalency and the uniform good quality of the ore.

The Upper Silurian, or Dyestone ore, may, with reasonable certainty, be assumed to occupy its regular place in the beds at the foot of the mountain, as indicated by the profile section. In this region it is everywhere covered by the abutting coal-measure rocks or by the talus from the ledges of overlying rocks. The tendency of the valley to wear away from the face of the mountain leaves a foot wall of horizontal Carboniferous rocks the whole length of the ridge, except at the water-gaps. And, contrary to the occurrence in the Cumberland mountain, the water-gaps are at points of least upthrow, so that the ore is not exposed the whole length of the mountain except at Elk Gap, (Safford.)

Along the face of the Cumberland mountain none of these conditions stand in the way of a study of the ore, which occurs in several beds, or interferes with the ready mining at many points far north and south. The time may not be far distant,

however, when it may be desirable, even at greater expense, to develop this ore in connection with the coking coals, which are being developed west of the Cumberland mountain.*

On Elkhorn creek another ore occurs which does not belong to the Pine mountain series; but as it is a local deposit along the face of the mountain, it may properly be described in this connection. This bed has the character of a recent deposit, though its occurrence at many points along the valley on both sides of the creek at the same horizon, apparently, and the similarity of the arrangement of the parts of the bed at widely separated exposures, make it appear like a continuous bed. It is made up of from one to three feet of anhydrous sesqui-oxide of iron, including many fragments of sand-rock and siliceous shale, the latter, apparently, greatly changed by heat. The ore is also in part blistered and porous, as though through the agency of heat. Resting on this there is generally found from one to two feet of earthy ore, or red ocher, with small fragments of siliceous rock intermingled. In general, the lower part includes too great a proportion of siliceous material in the form of fragments of sand-rock to be valuable. In places, as noted near Levi Potter's, it will probably be found comparatively free from these objectionable features. An analysis made at the Laboratory of the Survey of a sample from this place shows the following results:

Moisture.....	1.060
Iron per-oxide.....	59.630
Alumina.....	7.927
Phosphoric acid.....	.563
Phosphorus.....	.234
Siliceous residuum.....	29.73
<hr/>	
Metallic iron.....	41.74

It is probable that this ore is a rim deposit, but nothing has been noted which explains its occurrence at this particular horizon; and the appearance of metamorphosis cannot be readily explained from the data at hand. No indications of heat in connection with the Pine mountain fault have been observed at any place. But if this ore is a rim deposit, it is, doubtless, of later origin than the fault-ridge, and as it extends laterally

*For description of the Upper Silurian iron ores see report of P. N. Moore on the Iron Ores near Cumberland Gap, Vol. C., Reports on the Eastern Coal-field; also Vol. IV, New Series.

across the valley in association with the undisturbed coal-bearing strata, there is apparently no good reason for supposing that this ore has at any time been subjected to a high degree of heat, unless a burning coal-bed be assumed to have been the source. Locally coal-beds in this region are found to be burned out for a considerable distance under ground, but no indications of a coal-bed have been seen at this level. The most that can be said for this ore is, that it is probable that it may prove valuable as an iron ore locally, and generally as a source of red ocher. It is exposed along the Elkhorn valley, from near the mouth of Sycamore Creek towards the head for six miles or more. On Pigeon-roost Branch it is 285 feet above the main creek. On Harvey Gibson's land, opposite side of the valley, about the same level. It is relatively lower up the creek, being 150 feet above the main drainage at Levi Potter's.

COAL BEDS.

The coal-bearing rocks of this region are, as a whole, continuous with those of the lower counties. The series is greatly thickened, and includes an increased number of coal beds, but, as already indicated, presenting a section so different as to make the recognition of coal beds as continuous with those in the sections of the lower counties difficult, if not impossible. The progressive changes in the general character of the rocks in Lawrence and Johnson counties, as mentioned in the report on that region, are suggestive in this connection, but only a study in detail of the thickening series, from the outcrop to Pine mountain, can give a full solution of the question of equivalency of beds in the Eastern coal-fields.

There are some features that have been traced across the whole field which serve to indicate in a general way the relations of the parts of the vertical section in the different portions of the field. The shales above the conglomerate, fifty feet thick in the western part of Greenup, and 150 feet in Lawrence, are readily recognized on Elkhorn and Shelby creeks, in Pike county, with a thickness of 450 feet. Elsewhere in the Pound Gap region only a part or none of this portion of the section is above the drainage.

The first persistent coal of importance above the conglomerate formation is towards the top of these shales, in the latter as well as in the former region. The occurrence of calcareous concretions, which become abundant in Lawrence county, associated with coals 1 and 2, is even more noticeable in the Pound Gap region along with the coals of the same general level, here increased in number to four beds or more. These concretions are prominent in many localities, and at levels ranging through 300 feet of vertical section. (See Sections 7, 8, 13, 18 and 27.) They appear generally as lenticular earthy calcareous segregations, varying in size from a few inches to fifteen feet in greatest diameter. In some instances they are fossiliferous, and in many instances they show a well-defined concentric structure. Less frequently these calcareous deposits appear as more or less regularly jointed layers, or as continuous beds. Plate C shows some of these lenticular bodies as imbedded in the slaty shale at the top of the shale series on Carr's Fork of the Kentucky river, at Kelly's mill, in Knott county.

The section above is not so easily comparable with what may be supposed to be the corresponding part of the general section in the counties near the border of the coal field. There are some points of resemblance; and some features have been traced with some degree of certainty, across the intervening territory. But the requirements of this report will doubtless be satisfied without urging the matter of equivalency beyond these general statements.

There appears to be no workable beds of coal either below or in the conglomerate series of this region. There are no exposures to show the thickness of the sub-conglomerate shales. From the surface indications along the face of Pine mountain it is probable that less than fifty feet of the general section is occupied by these beds, which along the border of the coal field are relatively much more prominent, and at some points, as in Menifee county, include a workable coal. (Vol. IV., Part II., and Vol. C.) The conglomerate formation has a maximum thickness of 2,000 feet, made up of coarse ferruginous and more or less conglomeratic sandstone, alternating with shales in such a way as to form five or six benches where the whole series is exposed. Cross-bedding is a noticeable feature throughout the

formation. Quartz pebbles varying from the smallest to one-half or three-fourths of an inch in diameter, are somewhat irregularly prominent, forming what in that region is spoken of as hailstone grit; a rock from which millstones of good grinding quality are made. Thin beds of coal have been noted at points widely separated, as at the Breaks of Sandy, in the lower benches as exposed along the river; and on the Pine mountain, south of Whitesburg. Professor Stevenson finds six thin beds at Pennington's Gap, in this group (Geological Reconnaissance of parts of Lee, Wise, etc., Va.); and it is not unlikely that something like the same number would be found in this region if all the shales could be examined. On the re-appearance of this formation to the southwest in the region of the south fork of the Cumberland river, several inter-conglomerate coals are workable beds. (See forth-coming report on the coals of Pulaski and Whitley counties.)

The first coal bed of more than local importance, beginning at the base of the series above the conglomerate group, is also the No. 1 of previous reports. It is above the main drainage in most of the region included in this report; and it is traceable with a reasonable degree of certainty from the Graham coal of Carter, to the Paintsville coal of Johnson, the Warfield coal of Martin, the Prestonsburg coal of Floyd, and so to the headwaters of the Chatterawha or Big Sandy, and of the North Fork of the Kentucky. On Beaver creek this bed has a thickness of from three to five feet; the maximum being found, in the valley of the Right Fork, from the mouth of Rocky Fork, to Caney creek, including portions of the valleys of all the tributary streams of this locality. Enlarged Sections 1 and 6, Plate VII., show the general character of the bed in this region. The cannel coal, as represented, is probably limited to a small region; extending along the main creek less than one mile and extending for a short distance up Stone-coal creek and for a mile or so up Rocky Fork. On Dry creek, near the mouth and near the locality of Section 9 (see figures on the accompanying map which indicate localities of sections as numbered) a few inches of cannel is again shown as a part of this coal. The thickness in this locality is four feet of good coal. (Section 9, Plate II.) Toward the head of the creek it is reduced to three feet or less. (Section

6, Plate II.) On the Left Fork of Beaver creek the bed, as a whole, is considerably increased in thickness (Section 7, Plate II.), but with only forty-three inches of coal available for mining from the thickness of shale partings. On the river in the Laynesville region and on Mud creek a seam of unusual thickness (Section 11, Plate VII.), twenty to forty feet above the river bottom, probably represents this bed. In the Pikeville region this bed is represented by the lower coal on Little Chloe creek—Sycks' coal. (Section 1, Plate I.) On Shelby creek the Jackson Newson seam, on Robinson, fifty-three inches, including eight inches of shale, Keel's and William Hall's coals on Indian (Section 13, Plate III.), and possibly Tacket's coal on Long branch of Indian, fifty-one inches, including a six-inch parting, represent this bed. It is possible, however, that the latter coal is the Elkhorn seam higher up. On Elkhorn creek this bed is probably represented at its best by the sixty-five inch coal, as shown near Wade Sanders' on Sycamore creek. (Section 16, Plate VII.) From the numerous openings made by Mr. Broas on Elkhorn, this seam would appear to have an average thickness of about forty-four inches. On the head-waters of the Kentucky river, the main lower coal of Colly, Sand-lick, and Dry creek, and of Rock-house creek, above Little Colly, appears to represent this bed. (See Sections 18, 20, 21, 23, 25, 26, Plates IV., V, and VI.) Near Pound Gap, and also in the southwestern part of Letcher county, this coal bed is below the drainage level.

This coal seam varies greatly in thickness, and especially in the matter of partings. It is a good coal, however, throughout, and in some parts of this field it is the main coal.

The following analyses of samples which represent as nearly as practicable the whole bed, show the character of the coal in the different parts of the field:

Table of Analyses of the Lower Coal of the Pound Gap Region.

	Spec. gr. .	Moisture .	Vol. Comb. Matter. .	Fixed Carb.	Ash. . . .	Sulphur. .
Thompson's Sand-lick C. upper bench .	1.191—	1.10	40.90	55 40	2.60	1.453
Thompson's Sand-lick C. lower bench .	1.279—	1.10	34.30	57 20	7.40	.889
Candill's C. 2 M. below Whitesburg, upper bench	1.277—	1.30	39 60	55 20	3.90	2.812
Caudill's C. 2 M. below Whitesburg, lower bench	1.286—	1 60	36.40	56 60	5.40	1.060
Collins' C. Rockhouse Cr	1.242—	1.46	35.84	58.60	4.10	1.068
Wm. Hall's C. Indian Cr., Pike Co . .	1.294—	0.60	33.94	59.46	6 00	.876
Jackson Newson's C. Robinsons' Cr . .	1.311—	1.00	34.20	58.90	5.90	.903
Syek's C. Little Chloe Cr	1.367—	5.06	29.84	57.50	7.60	1.038
Mo. Mud Cr. Hatches C. upper part . .	1.302—	2.04	27.42	56.34	4.20	1.475
Mo. Mud Cr. Hatches C. lower part . .	1.281—	2.10	37.16	57.74	3.00	.596
Laynesville C. upper 23 inches	1.359—	1.30	36.70	51.70	10.30	1.356
Laynesville C. lower 45 inches	1.284—	1.90	35.80	58.94	3.86	.715
Laynesville C. lower 45 inches Coke open heap . . . . .	. . . .	0.60	. . .	94.70	4.70	.835
Martins C. Mo. of Steele Cr. Floyd Co .	1.323—	2.50	32 50	56.54	8 46	.651

In Letcher county a bed of coal having in places a thickness of thirty inches, is found twenty-five to thirty feet below the Sand-lick seam. (See Sections 18, 20, 21 and 26, Plates IV, V, VI.) This is the coal mined back of the school-house at Whitesburg, and also at Combs' store, on Rockhouse creek, at the mouth of Trace branch, but little above the bed of the stream. A thin bed has been noticed at several points in Floyd and Johnson counties, in a similar relation to the main lower coal. (Coal 1.) Above the Sand-lick coal, sixty to one hundred

feet, as shown in Sections 17, 18, 19 and 22, is another coal-seam like the previously described bed. It is mined for local use at one point only in this region—at John Wright's, near the head of Elkhorn creek, in Pike county. It may be seen, however, at many points, varying from one to three feet in thickness, and is persistent enough to be regarded as one of the regular beds of the region about Pound Gap. (See Analysis (a) general table.) Its relation to the next coal above is so nearly like that of the previously described bed to the main lower coal, that in some places one of these horizons may easily be mistaken for the other.

The next coal in the series, is probably the most important bed in the Pound Gap region. Better known on Elkhorn creek, in Pike county, than elsewhere. From developments begun there, this bed has come to be known as the Elkhorn coal. In the Big Stone Gap region, in Virginia, this bed is known as the Imboden seam. It is also known as the "Coking Coal" of that region, a designation which is applicable in the Pound Gap region from the coking qualities of the coal, as will be seen from such preliminary tests as have already been made. The area of the Elkhorn coal in its recognized character, includes, in a general way, the headwaters of Elkhorn and Shelby creeks in Pike county, of Beaver creek in Floyd and Knott counties, and of the Kentucky river in Letcher, including Millstone and Thornton creeks, the head of Rockhouse creek and also the head of Carr fork, in Knott county.

The openings made to develop this coal are mostly in Pike county and the adjoining part of Letcher. Plate VIII, A, shows its thickness and surroundings at a number of points, as measured at test openings driven to roofrock.* The place of the Elkhorn coal is at the top of the shale series, as previously described, and it therefore falls below drainage in the southwestern part of Letcher. It is so reduced in thickness and changed in character in this direction, however, so that it can

*The greater number of these openings were made by Mr R. M. Bross, for parties represented by him, at an expense which could not by any possibility have been met by the Survey, and it is but justice to say that this work was generously shaped to facilitate the investigations of the assistants of the State Geological Survey in this region. Workmen were also furnished by Mr Bross to cut out the column for the Louisville Exposition, under the direction of the writer.

hardly be regarded as one of the workable coals. The same is apparently true to the northward of the field, as imperfectly outlined above.

Though one of the large bodies of coal in the eastern field, as seen from sections, Plate VII, B, the chief importance that attaches itself to the Elkhorn coal, distant as it is from established lines of transportation, is in consequence of the coking qualities, which are found to be a leading characteristic of this bed. Tests in this direction have not been made for the whole body of coal as described; the unusually uniform character of the coal, as indicated by the accompanying table of analyses, goes very far, however, towards establishing, for a large territory, the superior coking qualities, which are shown by the tests in the Elkhorn region. Little comment is necessary on the results of coking tests, as given in the table which follows. The difficulties in the way of thorough investigation have been very considerable. Coking in small open heaps, even under the most favorable conditions, can hardly be supposed to secure the best results, and the transportation of large quantities of coal has not been practicable. Results in ovens have, therefore, been limited to a few bushels placed in wooden cases, along with the ordinary charge in regular coking ovens of the beehive pattern. To this method there are some objections, which could, however, hardly be regarded as detracting much from results uniformly better than the regular product of the ovens made use of. Two large boxes of Holcomb's coal, on the head of the Kentucky river, were shipped for additional tests in ovens, but were destroyed by the way along with other valuable collections. The results presented, though not so complete as might be desired, fully sustain the first views expressed respecting the Elkhorn seam as a most promising coking coal.

Analyses of the Elkhorn Coal and Coke.

COAL.	Spec. gr. . .	Moisture. .	Vol. Comb. Matter. .	Fixed Carb.	Ash. . . .	Sulphur . .
Holcomb's C., near head of Kentucky river, whole seam	1.291—	3.26	32.24	61.60	2.90	.656
Holcomb's C., near head of Kentucky river, lower 68 inches.	1.319—	2.86	31.54	62.10	3.50	.535
Mullen's C., near head of Elkhorn cr., whole bed	1.282—	2.60	34.20	60.80	2.40	.412
Mullen's C., near head of Elkhorn cr., lower part.	1.271—	2.00	33.50	60.54	3.96	.429
Cane br. of Elkhorn cr., upper part. .	1.355—	6.00	31.26	59.34	3.40	.390
Cane br. of Elkhorn cr., lower part . .	1.314—	2.54	32.26	62.20	3.00	.547
Mill br. C., of Elkhorn cr., upper part.	1.271—	1.60	29.36	67.40	1.64	.610
Mill br. C., of Elkhorn cr., lower part.	1.278—	1.60	32.10	64.64	1.66	.711
Bear Fork of Robinson cr., upper part.	1.294—	0.40	33.20	62.46	3.94	.642
Bear Fork of Robinson cr., lower part.	1.273—	0.40	34.80	60.46	4.34	.711
Fleming's cr. C.,	1.350—	3.80	33.80	60.60	1.80	.475
Imboden bed, Virginia . . . . .	. . . . .	1.38	35.92	60.59	1.51	.594
Mill br. C., (coked at Connellsville) . .	. . . . .	1.80	26.80	67.60	3.80	.967
COKE.						
Mill br. coke, open heap . . . . .	. . . . .	2.86	. . .	88.44	8.70	.844
Mill br. coke, in oven, Cincinnati . . .	. . . . .	0.20	. . .	93.20	6.60	.734
Mill br. coke, second sample in oven, Cincinnati. . . . .	. . . . .	0.06	. . .	94.34	5.60	.788
Mill br. coke, in oven, Connellsville . .	. . . . .	1.20	0.60	94.14	4.66	.906
Mullen's cr., coked in open heap, upper part . . . . .	. . . . .	1.10	. . .	95.40	3.50	.517
Mullen's cr., coked in open heap, from whole bed . . . . .	. . . . .	1.06	. . .	90.40	8.54	.598

The physical properties of the Elkhorn coke have not been studied in detail, and in fact, the conditions have not been possible for a complete comparison with the standard products of

established coking industries of the country, for reasons which have already been stated. The coke obtained by the two methods as described above appears to have the requisite strength for all furnace purposes. It has a bright metallic lustre, and is porous enough for free combustion in the furnace. In the last respect the results of experiment at the laboratory of the survey are not without interest.

For comparison with the standard cokes of Pennsylvania, so far as that has been attempted, the plan adopted was that based on the inch cube of average coke, subjected to tests by weight dry, and filled as perfectly as practicable with distilled water, by the aid of the air-pump. The coke used was made as above in a Cincinnati oven, reducing by the formula indicated by the tabular statement of the Pennsylvania report (Vol. L, pages 82 and 128). An average gives the following comparative results:

	WEIGHT IN GRAMMES.		PERCENTAGE	
	Dry	Filled with Water.	Coke	Cell Space
Pittsburg & Con. Co. Coke.	12 46	20 25	61 53	38 46
Elkhorn Coke.	12 59	20 688	61 71	38 24

This comparison shows a striking similarity to the well-known Connellsville coke, which may fairly be regarded as standard.

But while this statement is correct enough for a comparison of the physical structure of the two cokes in this respect, in order to get a correct notion of the actual structure of standard cokes, it should be noticed that the assumption on which the determination of the per cent. of cell space to the coke is based, is very far from a correct one. For the increase in weight by filling the cells with water, is in the one case 8.098 grammes, and in the other, 7.79 grammes; equal to nearly one-half cubic inch of water, indicating nearly 50 per cent. of cell space. Or, accepting the cubes and the weights as correct, in the Connellsville coke the per cent. of cell space to solid coke is 47 to 53, and in the Elkhorn coke the per cent. is 49.5 to 50.5.

Determinations of the specific gravity of the Elkhorn coke play also an important part in this line of experiment. Repeated trials show some variations in results; but a close approximation to the true specific gravity is found to be 1.72, instead of 1.53, which should be the specific gravity if the above determination of the percentage of cell space to coke be assumed to

be correct for an exact cubic inch. This would increase the cell space in the Elkhorn coke to nearly 55 per cent.; and indicates for the Pittsburgh and Connellsville Co.'s coke about 53 per cent. Corrections for the inexactness of cubes used would modify these figures somewhat, but these findings are still apparently below the actual percentage; for, as is found by observation and experiment, this increase in the per cent. of cell space represents very largely the extent to which the external pores are emptied on removal from water for weighing by the first method.

And it does not in any way represent the error that arises from the fact that some of the cell spaces within will be imperfectly filled, as a rule. This last is shown in every effort by long continued and repeated exhaustion under the receiver, with long continued immersions in water under the normal pressure of the atmosphere, and under pressure, to reach a final limit of the absorption of water.

These results though presumed to be correct in principle, must, however, be regarded as close approximations only, as will be seen by those who have made repeated tests under even the most favorable conditions of uniformity in density of representative samples, and of success in the filling of cell spaces with water; neither of which will be assumed with unqualified certainty by any one who has pursued this line of experiment. The

Soon after beginning these tests it was presumed that no more water would adhere to the tube on removal from immersion than would fill the surface pores; and on the other hand it was assumed that the adhering water would, with sufficient accuracy, represent by weight the partially filled cells at the surface. Later, it was found that this assumption was a source of error. The limit of this error has not yet been accurately determined; but the examination of the surface when first taken from the water, by the aid of a magnifying glass, shows very clearly that the source of error here is too great to be neglected in the determination of percent of cell space.

It may be added that results obtained on this point indicate an error from this cause, amounting to about 25 per cent.

A detailed account of experiments covering this point and others involved in the determination of the porosity of cake, will be given as soon as the series of tests necessary for more specific results have been completed.

It should be stated, however, that after the above series of determinations had been completed, a parallel series of experimental determinations for the Elkhorn coke was begun, from which the following results (subject to correction) are obtained:

(1)	Weight of cubic inch of coke (corrected for vol.)	12.87	grammes
(2)	Weight of same filled with water (cor for vol.)	21.46	
(3)	Weight of same in water (corrected for vol.)	5.52	
(4)	Loss of weight (2, by drainage from surface)	42	
Specific gravity			1.76
Per cent. by vol. of coke			47.5
cell space			52.5
" " " " (cor for loss (4))			56.0

Correction of volume was made by carefully sealing the surfaces of the cube and measuring by displacement.

range of variation is so great, however, in the physical character of cokes from different coals, that pursuing the same method of investigation with each, conclusions of real significance and of practical value can be made as in the table above. To make the comparison most satisfactory the coking should be done under similar conditions. This has not been possible in this instance as has been explained, and the margin for error in this respect is understood to be limited only by such care and judgment as the writer and other assistants of the Survey have been able to exercise in the several stages of the work.*

The coals of the sandstone series, above the Elkhorn seam, are rarely exposed without excavation, and great difficulty has attended the work of determining the serial relation of beds which could be examined at wide intervals only at best. Some of these beds are persistent, and retain characteristic features over large areas. Others, though probably continuous seams, are greatly changed in appearance and surroundings, from place to place. Several coal beds are found only in exceptionally high points in the several counties. In so large a field, and one so entirely undeveloped, it would not be surprising if some bed has been overlooked. The greatly varying intervals between beds, and the varying character of the intervening rocks, has added to the difficulty of the work. It is impossible, therefore, as yet, to present a general section for the whole Pound Gap region which is entirely coherent in all its parts.

The first coal of importance above the Elkhorn is a splint and cannel seam on the Kentucky river waters. On the Big Sandy side of the water-shed it is less constant in character, but generally present. This bed marks the lower cannel coal hori-

*Since this report was written a paper has come to hand, by Mr. F. P. Dewy, of the Smithsonian, on the "Porosity and Specific Gravity of Coke." The result of a more extended and accurate study of some of the physical properties of coke than has heretofore been made. The average specific gravity of the various Connellsville cokes as found by Mr. Dewy to be 1.74, and the average porosity 49.82 per cent. of the volume, the maximum being 57.21 per cent.

These findings, though reached by a method different in part and in some respects more direct than the one adopted here, confirm the results given in this report.

A slight increase in porosity obtained by the method pursued at the Laboratory of the Kentucky Geological Survey, by an estimate of water lost from the surface cracks by drainage, a difference amounting to about 2.5 per cent., as explained in a foot note on page 28. This would apparently increase the average porosity of the Connellsville cokes to about 49 per cent., or in general terms, taking the Connellsville cokes as standard, the proportion by volume of cell space in the best metallurgical coke is nearly 50 per cent. instead of 33 per cent., as given by Fulton in Vol. L, Pa. Rep.

zon of Letcher and Knott counties, though it is more generally a splint or common bituminous coal, with a smaller proportion of cannel, which in places becomes a prominent part of the bed. (Compare Sections 22, 23, 25, 27 and 28). It is exposed at other points in the region represented by these sections, and also westward—notably at Esq. Cornet's, on Carr's Fork, at the mouth of Sassafras creek, where it shows an excellent splint coal fifty-four inches thick, including two or three inches of "bone coal." On Wolf-pen branch of Carr's Fork this bed is opened at John Amberg's, showing above a five to six inch clay shale, parting thirty-four inches of common bituminous coal, and below, twenty-six inches of very excellent cannel.* (See enlarged section, Plate VII, A.) The rocks between this bed and the Elkhorn coal have an average thickness of about 140 feet, mostly thin bedded sandstone, generally forming a well-marked shoulder along the hill-side. Sometimes, besides the thin coal just above the Elkhorn seam, a thin bed of coal may be found in shales, which replace part of the sandstone ledge, separating it somewhat irregularly into two parts.

On the waters of the Big Sandy this bed is represented by the nine feet coal, with many thin clay partings; Section 19, probably by Marrs' coal; Section 10, the twenty-two inch coal; Section 8, the corresponding thirty-nine inch in Section 5; and in the Pikeville region, Marrs', Swords', the upper Chloe creek, and Gillam's coal (Sections 1 to 4), though possibly the two former beds in this last region belong higher up, representing the "upper splint" next to be described. Down the river the lower splint coal is found, showing at a few points only, 200 and 250 feet above coal No. 1, of Floyd county, as on Sugar-loaf branch, five miles above Prestonburg, at Mr. Gobble's. Here the seam is again mostly splint, and it appears to be about four feet thick. Analyses of samples from some of these points are given in the table (*c* to *k*, inclusive). (For the extension of this coal westward into Perry and Breathitt counties, see accompanying report of Mr. Hodge).

One hundred feet or more higher in the series is found another splint and cannel seam, as shown in Sections 10, 11, 12,

*It is possible that Collin's upper coal, Section 20 and the equivalent bed in Section 21, fall at this level, but is more likely that they represent the next bed above, the "upper splint" though the middle coal of Section 21 appears to be the Elkhorn seam.

14, 20, 21, 25, 26 and 28. Next to the Elkhorn this appears to be the most important bed in the Pound Gap region. By way of distinction, it has come to be known to some extent as the "upper splint," a name that is descriptive for only a part of the area over which it has been traced. It is mined on Cowan ridge, opposite Whitesburg, by Mr. Nickles, for the the grate. It has here an average thickness of forty-six inches of free burning coal, which is hard enough to bear handling without the usual amount of waste. The same character, with increased thickness, is shown in the Smoot and Dry creek regions. On Thornton creek it shows, indifferently opened, three feet of coal. The thickness of Collins' upper seam, which is referred to this geological level with some doubt, is given as reported by Mr. S. Kiser, who was employed to face it up. (See enlarged section, Plate VII, A.) The upper bed, at the old place of Dr. Breeding, near the head of Camp branch of Rockhouse creek, is reported nearly as thick. This appears not unlikely, as seen at the outcrop. Westward, in Knott county, the place of this bed is marked by the outcroppings of cannel coal toward the top of the ridges. It is shown in the extreme northeastern corner of the county, in Section 5, as a forty-five inch splint coal. Analyses of samples of coal representing this bed, general table, (*l*) and (*m*). In Pike county this bed is best represented by the Dorton branch, the Bear Fork and Marrs' cannel coals. (Sections 10, 12, and 14). (See also Plate VII, A.) It is quite probable that the upper coal on Stone Coal creek, or Coal Run, below Pikeville Section 4), represents this bed. It will be seen from the map (see figures indicating locality of sections by number) that this bed covers a large area on the head-waters of the Kentucky and Big Sandy rivers. The Bear fork region promises well as a cannel coal district.

In the Robinson creek region another cannel horizon is found (Sec. 11 and 12, Plate III,) at the base of a coarse sandstone ledge, and but a little above an outcrop of indurated clay, which accompanies a thin coal. Little is known of this seam in Pike county beyond the fact of its presence, as indicated by tailings, and it is too high in the series to be found in Floyd, except on the left fork of Beaver creek and on Big Mud creek. It appears to

be represented on Sycamore creek in the Elkhorn valley in Sections 15 and 16 by the lower of the two thin coals near the top. So far as known, no considerable importance attaches to this horizon in this part of the Pound Gap region. In Letcher county, however, it appears to be represented by Kiser's six feet coal. (Section 24, analysis [n.]) In Knott county it is represented by the twenty-six inch coal near the top of section 6, plate II.

In Letcher and Knott counties, sixty to eighty-five feet above the previously described bed, is a coal-seam which is interesting, so far as known, only as an illustration of frequent alternations in the conditions of deposits. Sections 6 and 24, with enlarged section Plate VII, A., give the details of this bed. About 200 feet higher up, and limited to a few hill-tops because of its high place in the series, a thick coal bed 80 inches, including a 4-inch parting, is found in the border of Knott county. (Sec. 27.) A 24-inch coal was opened about 50 feet below. Some of the ridges in Letcher are equally high, but the dip of the formation is such that they do not include this bed. The limestone beds, Sections 26 and 27, illustrate this point. In Pike county this seam is opened on Sycamore creek, showing 92 inches of coal. (Sec. 16.) There is a large area in the flat woods region for this coal. This table-land rises much higher above the drainage than the other hills along the belt adjacent to, and on the northwest side of Pine Mt. It also exceeds all other portions of this belt in the height of the geological section presented, by something more than 400 feet. This interesting feature makes the relation of the sections north and south of Pine Mt. more intelligible by showing that the great disproportion generally, in the thickness of the coal measures above the conglomerate, as represented on the two sides of the mountain, is caused by unequal erosion. (See sections in report of Mr. Thruston on the Poor Fk. region in Harlan county.) About 300 feet above the 92-inch coal last mentioned, on the shoulder of the Flat woods table-land, another thick coal occurs. The thickness is not known. It is reported in a well, 10 feet thick. It shows as a prominent stain in the soil, with abundant fragments of coal at a point where once partially opened. Its place in the series corresponds in general with one of the thick coals

in the upper portion of the Harlan section. The hill here is about 150 feet higher, rising in a narrow ridge above the table-land.

Gathering the data at hand into a provisional general section, gives the following interesting exhibit of the vertical distribution of workable beds of coal in the Pound Gap region:

Top of highest hills in Pike county N. of Pine Mt.

150 to 175 feet covered slope.

Flat woods coal. Reported as a thick bed.

300 feet, more or less, mostly coarse massive sandrock.

Ambergys 80-inch coal. Sycamore Cr. 92-inch coal. (Highest workable seam in Knott county.

50 feet shale and sandstone.

Thin coal. (Sec. 27.)

25 to 40 feet sandrock and shale. (Highest rocks in Letcher county north of Pine Mt.)

Fossil and bastard limestone horizon. (20 feet shale.)

150 feet coarse sandrock, with shale divisions, forming benches.

Coal with many partings.

60 to 85 feet, mostly coarse massive sandrock.

Kisers 6-feet coal. (Letcher) Bear Fk. cannel, (Pike.)

150 to 175 feet, mostly sandrock.

Upper splint coal, 36 to 80 inches.

100 to 130 feet shale, shaly sandstone and sandstone.

Lower splint coal, 36 to 60 inches.

125 to 150 feet, mostly sandstone.

Thin coal so far as known.

15 to 40 feet, shales and sandstone.

Elkhorn coal, 40 to 108 inches.

20 to 40 feet, shales mostly.

Wright's coal, (Sec. 9, 17 and 22,) 12 to 42 inches (analysis (a).)

50 to 75 feet, shales mostly.

Sand Lick coal (No. 1,) 36 to 60 inches.

25 feet, sandstone and shale.

Combs' coal, (Sec. 20, 23 and 26,) 12 to 36 inches.

300 to 400 feet, shale and sandstone, the latter prominent in

places. Several thin coals; irregular but probably locally workable.

2,000 feet conglomerate formation, divided by shale beds of greater or less thickness into five to seven benches. Including several thin coals.

General Table of Analyses of Coals.

	Spec. gr. . .	Moisture . .	Vol. Comb. Matter. .	Fixed Carb.	Ash	Sulphur . .
(a) Bear Fork, 32 inch coal	1.310	1.60	30.80	62.80	4.80	0.555
(b) Head of Camp br., 45 inches	1.317	1.26	80.00	52.70	5.74	2.752
(c) Gillam's cr., upper 31 inches	1.279	2.20	36.10	58.10	3.60	0.651
(d) Gillam's cr., lower 31 inches	1.293	2.40	35.40	58.26	8.94	0.692
(e) Head of Little Chloe cr., lower 56 in.	1.273	1.40	38.66	58.60	6.34	0.825
(f) Marian Hale Trace br., splint. 44 in. . . .	1.30	1.30	38.10	58.40	2.20	0.710
(g) Wolf-pen cr., upper 34 inches	1.385	5.46	31.68	57.46	5.46	0.488
(h) Wolf-pen cr., cannel, lower 26 in. . . .	0.26	47.94	44.86	6.94	0.751	
(i) Mouth of Sassafras cr., 54 in. . . .	1.305	1.30	34.70	56.10	7.90	0.437
(k) Bentley's cannel coal	1.305	1.90	39.32	51.88	6.90	1.115
(l) Bear Fork cannel coal, 38 inches . . .	1.293	2.00	43.40	46.30	8.30	0.689
(m) Nickel's splint coal, 46 inches . . .	1.320	1.34	34.16	56.70	7.80	1.318
(n) Kiser's 6-foot coal at out-crop*. . .	1.483	6.66	31.00	46.94	15.40	0.488
(o) Hager's cannel coal, Little Paint cr., Johnson co., 36 inch.	1.227	1.80	49.18	41.92	7.15	0.802

* In this coal the ash is probably doubled by adhering clay.

NOTE.—Columns cut out to represent the whole thickness of coal-beds were obtained for the World's Exposition, at New Orleans, from the following beds: Martin's coal (No. 1); Right Beaver, at mouth of Steele creek, Floyd county; Flemings creek coal (Elkhorn), Floyd county; Elkhorn coal, Elkhorn creek, Pike county; Elkhorn coal, Potter's Fork of Kentucky river, Letcher county; King's creek block-coal, Letcher county (see report of Mr. Hodge); Wolf-pen cannel coal, Knott county; Ambergys, 80 inch coal, Knott county; Hager's cannel coal, Little Paint creek, Floyd county; Wheeler's coal (No. 1), below mouth of Big Paint creek, Johnson county (see report on Morgan, Johnson, etc.).

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PRELIMINARY REPORT ON THE GEOLOGY OF PARTS OF LETCHER, HARLAN, LESLIE, PERRY AND BREATHITT COUNTIES

A rapid survey, made over a considerable area, in continuation of the work of Prof. Crandall on the headwaters of the Kentucky river, where well defined marks of persistent beds are rare, has proven insufficient to carry the identification of strata to any great degree of detail. Enough work has been done, however, to trace the more important coal beds with a fair approach to certainty, wherever they appear of workable thickness. But it should be understood that, in this report, assumption of identity established is based frequently on what from personal observation is believed, but not known to be reliable evidence, and which is, therefore, still open to revision.

The region covered by the survey includes that part of Letcher county, lying north of Whitesburg, and between the west fork of Kentucky river and Pine mountain ; the head of Greasy creek in Harlan county ; in Leslie county, Cutshin creek to the mouth of Wooten ; in Perry county, Leatherwood creek, the North fork to the mouth of Big creek, Lots' creek, Lost and Troublesome creeks ; and in Breathitt county, Troublesome, Lost and Big creeks. Excepting Buckhorn creek and Ball's fork, the tributaries of the creeks named are generally included.

The strata are found to have a slight inclination, generally corresponding in direction with the course of the streams. They have their highest elevation against Pine mountain, about the head of Greasy creek, where, probably, the lowest coal above the conglomerate appears, dipping thence gradually down that stream and Line fork, but with somewhat more rapidity down Cutshin and Leatherwood creeks. On Line fork, from Pine mountain to Defeated creek, the strata lie nearly level, and an

approximate line of strike appears to run, following the direction of Defeated creek, across to near the mouth of King's creek.

Northwest of this line an inclination is found sufficient to carry a coal bed lying 300 feet above Line fork at Isom's, down to 70 feet above the Kentucky river near the mouth of Lot's creek. The same coal bed is found at about the latter height above stream near the mouth of Wooten creek, on Cutshin, and again at the Tunnel mill on Troublesome creek. North and west from these points the dip is not quite so rapid as the fall of the main streams, which have a very gradual descent; the bed referred to above being about 100 feet above the river at the mouth of Troublesome creek.

If the coal beds have been correctly traced, there are partially developed, in this region, eight beds of workable thickness, of which number five are more or less frequently found as part cannel coal, but oftener as splint, and two others contain much splint coal. It is probable that some of these splint beds will be found valuable for coking, but no trials for determining this have yet been made. The table given on page 48 of analyses of samples collected from various openings, furnishes means of judging which are most likely to prove favorable in this regard. Particular attention is called to the admirable quality of the two samples of cannel coal included in the table.

A ninth bed to be described is the "Elkhorn" bed of Pike and other counties. Though some of the coal from this bed has been used near the mouth of Leatherwood and Troublesome creeks, in Perry and Breathitt counties, it is not classed here as a workable coal, and it derives its chief importance in this report from the fact that to the eastward it becomes one of the most valuable beds of the State. Other beds, too thin to work, appear and disappear throughout the strata with great irregularity, and are of so little importance as to require no especial notice for a long time to come.

The lowest worthy of remark in the series, and one of the lowest beds of the coal measures above the conglomerate, appears above drainage in the region under consideration only on Greasy creek, Harlan county, and possibly on and near the Kentucky river, below Whitesburg. On the river it has not been found

of workable thickness. On Greasy creek it has a thickness of 3½ feet, as shown in the lowest bed of section 42, at the only place where it has been opened. Further investigation is necessary to determine whether the deposit continues of sufficient thickness to render it of especial value. The outcrop extends up Greasy creek, probably to about the mouth of Big Laurel, and short distances up the branch streams below.

The coal appears from its surface opening of excellent quality, the greater part a high grade bituminous, possibly a coking coal. A peculiarity is to be remarked, found in the upper 16 inches of this, and in some of the higher coals on the heads of Greasy and Leatherwood creeks, consisting of the absence of all evidence of lamination, resulting in the formation of slickensides coal, a coal closely resembling anthracite in its cleavage, and somewhat in its lustre, but without the strength or hardness of the latter, and burning very freely with a bright yellow flame. An analysis of a specimen of this coal from the head of Leatherwood creek is given in the accompanying table. Its specific gravity and composition point to its being a partly formed cannel coal.

The next coal above in the series, partly a cannel coal, is most prominent, though perhaps not most valuable, on Greasy creek, where, on Half-Mile branch, Abner's branch, (section 42) it has a total thickness of coal of 7 feet, and of bed of nearly 13 feet, but its five partings materially injure it. Farther east on the main creek, these partings are so enlarged (section 41) as to form several distinct beds, which are still more separated on the heads of Leatherwood creek. A good workable seam is found there on Stony fork, a part of it being the soft "slickenseit" coal already described, and the remainder mostly an excellent hard splint. An analysis from an average sample taken from the whole bed, as shown in section 40, is given in the table of analyses.

On the main head of Leatherwood, as well as on Greasy creek, it is in part cannel coal, and it is probably the same seam which shows close to the bed of Leatherwood near the mouth of Clover fork, a splint coal of 32 inches or more, and again near the mouth of Owens' branch, 27 inches or more, with two thin partings, the two inches at the top being cannel coal. It drops below drainage not far from the latter place, and gives rise.

probably in connection with another seam of the same bed, to the report of 12 feet of coal immediately below the surface of the ground, said to have been discovered in boring the salt well at the mouth of Leatherwood creek. Its outcropping as a thin bed on the river, a short distance above and below, as well as on Leatherwood creek, leads to the belief that the report is founded on a very small basis of fact.

On account of a local change of dip to nearly horizontal, one seam of the bed appears at Wm. McIntyre's (section 45) on the low water level of the river, two miles below Leatherwood, while six miles above the mouth of the creek (section 36) a part of the bed is 100 feet above the river there, and there again it contains a small seam of cannel coal. Farther east and to the south its separation into small seams precludes its specification, until, on Line fork, one seam disappears below drainage at John Holcomb's, while upper ones probably remain above as far as and beyond Hardin Sparkman's.

The third bed to be considered is the "Elkhorn" bed, previously referred to. Below Whitesburg, on and to the south of the river, it is thin and insignificant, until at the mouth of Leatherwood creek it attains a thickness of about two feet, with two or three partings. Its accessibility there led to its being mined a little for use at the salt well and neighboring houses. Followed up Leatherwood the partings increase, and on Greasy creek it seems to be merged in the bed below it. At Pennington's, on Cutshin creek, Leslie county, it is distinct again, but thin (the lowest bed of section 44), and its outcrop is exposed at several points on the road down to Wooten creek as a thin stain, at a nearly uniform height above Cutshin creek.

On the North fork, a mile above Hazard, its thickness is increased to 3 feet, (section 46), but it is so divided by partings, and apparently so impure, as to be without present value. It is lost beneath the river at the mouth of Lot's creek, but appears on Troublesome creek, where it has been traced some six miles up from the Tunnel mill, maintaining a height above the creek of about 15 feet, with a thickness varying from 1 foot to 2½ feet. Below the Tunnel mill it is represented by the thin seams shown at the bottom of section 49, and again is found thick enough to mine for local use at the mouth of Rus-

sell branch. Some coal has been taken also from the same bed in Lost creek, near its mouth, and from the river at the mouth of Troublesome creek, where two seams, 3 feet apart, are exposed at very low water, with a thickness of 20 and 12 inches. Followed up the river these seams rapidly separate to a distance of about 30 feet, and both appear above drainage on Big branch, together with a possible third seam, but whether a third seam, or the reappearance of the second at a higher elevation, has not been satisfactorily determined. In section 55 three seams are represented.

On Lost creek also a rise of strata has occurred similar to that near the mouth of Big branch, but of less marked degree, and the seams do not appear to be so separated there. Ten feet above the level of the mouth of Leatherwood branch of Lost creek, the bed shows but 15 inches of coal, with two thin partings, and again at the mill about two miles below the mouth of Ten-Mile creek, 17 inches of coal with four thin partings. At the mill-dam it disappears under the creek.

No samples for analyses of this coal have been collected from this region, but its quality does not appear to the eye to be so good in Perry county as in others where examined, those exposures which have been open to the air for a long time having become encrusted with a white coating, tasting strongly of alum. In Breathitt county this has not been observed, except in the upper seam on Big branch, the coal from the lower seam having an excellent reputation as fuel, both raw and coked.

Doubtless the most valuable bed of the series in this region is that which lies next above the "Elkhorn" bed, owing its importance not alone to its large area of good thickness, but also to its quality. As a bituminous coal it rarely shows other than an admirable quality, both by analyses and by its behavior in the grate, and this is equalled or surpassed where tested as a splint coal, which is its most prevalent character, while its frequent outcropping as an excellent cannel coal adds still more to its value.

From Whitesburg down the river to the mouth of Mace's creek, is a region practically barren in this as in other coals, it having a thickness at Wm. McIntyre's, below Leatherwood creek, of but 15 inches of coal, (section 45,) while at Allen

Christian's (section 26,) it is reduced to 5 inches. But to the south of the river (the region to the north being covered by report of Prof. Crandall) the thickness increases at Moses Isom's, on Line fork, to 25 inches, mostly cannel coal, and at Ira Hall's, on Defeated creek about two miles from the mouth, to 36 inches of handsome block cannel. On Dry fork of Line fork, its thickness diminishes again to 12 inches, 11 inches being cannel, while across the divide near the head of King's creek, it attains its maximum thickness, so far as known, of 78 inches, of which five feet is a block splint coal, which has been mistaken for cannel, and the remainder is bituminous. Unfortunately for this locality, however, it appears to be reduced to 25 inches a quarter-mile down the creek: but there is abundant room for a large deposit of thick coal, with nothing to indicate an improbability of finding it under the hill to the south and east of the opening made.

Toward the head of Line fork it has been found only at Holcomb's with a thickness there of 22 inches. On Greasy creek it has not been identified positively, but it is most probably represented by the 55 inches of coal shown in section 41, the bottom coal being a slickenseit, the top splint coal and the whole of excellent quality. On Stony fork of Leatherwood it appears with 16 inches of cannel coal and 13 inches bituminous (section 40.)

On Cutshin creek it begins to show a more even thickness, with a better average. It is probably the bed which passes under the creek at the mouth of Laurel fork, bituminous coal, twenty-nine inches thick, increased at Levi Boggs' (section 43) to thirty-eight inches, of which all but six inches is cannel coal. At Isaac Pennington's (section 44) a further increase would obtain but that the lower eleven inches of the bed is there replaced by a bituminous slate, hardly to be distinguished from block cannel, and showing in its composition a near approach to cannel coal. An analysis of it is given on page 48, with those of the other coals. At J. C. Lewis', near the mouth of Wooten creek, the bed reaches a thickness of fifty-six inches splint and bituminous coal, with a fire-clay parting of five inches, and at Elijah Cornett's, on the river above Hazard, fifty five to sixty inches of the same coal, with but one inch parting, and from there it has

been mined and shipped down the river by boat. At Hazard the upper seam alone, thirty-three inches thick, is worked for the supply of the town.

In the bend of the river, a mile and more below the mouth of Lot's creek, a number of old openings, now fallen in, indicate a thickness ranging from three feet to five feet, and many other openings still farther down the river are reported, from all of which coal was shipped to Frankfort and other markets, until the recent opening of new railroads in the central part of the State provided cheaper and safer transportation from other fields.

On Lot's creek the bed is distinguished as containing twenty-two inches of particularly fine cannel coal, having by analysis but 6 per cent. of ash, with about the same thickness of bituminous coal. (Section 47.) On Troublesome creek it is thin again, but on Lost creek, first seen thirty-three inches thick near the mouth of Ten-mile creek, to the south of which it goes below the drainage. It is opened at G. W. Noble's, a half mile west of his house, thirty-four inches thick, and a mile south-east of the house, with the following section:

Bituminous Coal.....	22 inches.
Shale Parting	6 inches.
Cannel Coal	17 inches.

An analysis is given in the table of coal from the thirty-four inch opening.

An entry was made into this bed, near the mouth of Lost creek, by Judge Strong, and afterwards abandoned on account of water, in which was found only bituminous coal, although the bed crops out as cannel coal in an adjoining field. On Big branch (Breathitt county) it is represented by the fourth coal of section 55, and the cannel coal now mined and shipped down the river from George's branch, which has a reputation more than local, is probably from the same bed, as judged by the character of the coal and its known approximate geological position.

It is well to remark, as an indication of the value of this bed throughout a large part of the region embraced in this report, that on George's branch the only opening accessible and mined in the summer of 1884 had a section at its working face of:

Bituminous Coal.....	3 inches.
Splint Coal.....	17 inches.
Cannel Coal.....	17 inches.

Although the upper 20 inches is excellent coal of its kind, it was treated as waste, the cannel coal alone being able to bear the expense of two miles hauling by wagon and subsequent shipment at high water by boat, with its attendant risk of loss by wreckage. That a large and profitable development of these fields may be attained under the advantages derived by means of railroad transportation cannot be questioned.

From the foregoing notes of this bed, it is evident that a heavy body of coal exists, extending from Lost creek across the North fork, and between Cutshin and Lot's creeks to Carr's fork (beyond which reference should be made to Prof. Crandall's report), with rich pockets on Defeated and King's creeks, in Letcher county. Whether that on the head of Greasy creek is a part of a large area of thick coal or a small pocket remains to be determined. Its most important outcroppings as cannel coal are on Lost creek, 17 inches; Lot's creek, 22 inches; Cutshin creek, 32 inches; on Line fork, 20 inches, and on Defeated creek 36 inches; all but the latter being accompanied with bituminous or splint coal.

Lying from 15 to 50 feet above the bed last described is another one, generally bituminous or splint, but possibly containing cannel coal on Troublesome creek, above the Tunnel mill. Further investigation, however, may prove this to belong to the bed below. It appears to best advantage over the main body of the bed beneath it, and the two are in some places so close that the economy suggests itself of making there one connected mine in the two beds together.

Its greatest thickness discovered is at Pennington's, on Cutshin creek, 60 inches, excluding partings. At Boggs', further up the creek, it is reduced to 36 inches of coal. On Leatherwood creek section 39 it has 29 inches of coal, of which two-thirds is an exceedingly rich slickenseit, as shown by analysis on page 48. At Isom's on Line fork it is 36 inches thick. (The two openings of that thickness shown in section 34 having been made at points a considerable distance apart, though shown at different levels are considered as probably in the same bed.) At McIntyre's, section 45, the same thickness of coal was found, but it is there divided by three partings. On Lot's creek, 34 inches of very bright coal, has but one parting. On Lost creek

it appears above drainage at Jacob Niece's, 26 inches thick, and retains this thickness at the mouth of Ten-mile branch. On Mill branch it is mined, on account of its proximity to the mill where it is used, with but 24 inches of coal, and that of poor quality. Further north it increases again to 36 inches on Big branch.

The next bed in order, seems to be quite as persistent as the others, but is, generally, too thin to be of much economic value. It is shown, the third bed from the top of section 31, as a thin coal, much separated by partings, and again on the Cutshin-creek sections, 6 inches and 12 inches or more of coal. The 15 inches stain on Greasy creek (section 41) is probably of the same bed, and it is identified on Tolson creek and at McIntyre's below Leatherwood creek, at each place 9 inches of coal. On Lot's creek it is found only 2 inches thick, but suddenly reaches 60 inches on Comb's branch, Troublesome creek (section 48), entitling it to be classed as a workable coal. (For analysis, see the table on page 48.) The only other point where it has been found of considerable thickness is on Tom's branch, Troublesome creek, as represented in section 49.

On Lot's creek it has been traced as a thin coal, without evidence of any pocket there. On Russell branch, Troublesome creek, the rapidity of change of thickness which sometimes occurs is well displayed in this bed. At the spring by James Rholley's house it may be seen less than 1 inch thick, while it is exposed as a handsome splint coal, 22 inches thick, about 100 yards farther up the branch. Whether it continues to increase beyond there can only be determined by mining, as it very soon goes below the drainage.

The sixth bed in the series developed, neglecting undefined thin seams, lies generally about 60 feet from that below it. This is another one of the particularly valuable beds of the region, though its area of thick coal in this region seems to be confined mainly to two widely separated and not very extensive deposits. As a cannel coal it has won a high reputation in Central Kentucky, where it is known as the Haddix (incorrectly Haddock's) coal.

One of these bodies of thick coal is first encountered at the eastern margin on Line fork at Isom's, and again at Holcomb's,

at both points having 32 inches of coal, but in the former separated by two partings. Farther west, on Turkey creek (section 33), an increase to 53 inches is exhibited, and at Sparkman's (section 32), to 62 inches without partings. Its appearance here and analysis (for which see table of analyses) are alike favorable to its being a coking coal. Its low percentage of ash is especially remarkable, because its outcrop opening was so soft and penetrated by mud that it was impossible to obtain a clean sample. The bed has not been identified on Greasy creek, but this is due to insufficient search rather than to its absence. A report of thick coal on Turkey fork of Big Laurel creek is supposed to apply to this bed, its approximate level corresponding with the Shepard opening across the divide on Oldhouse branch, where it is exposed, an excellent splint and bituminous coal, 70 inches thick. Farther down Leatherwood and on Cutshin creek, it has been found only as a thin bed, the upper one of section 44. On several branches of Lot's creek, openings have been made on what is presumed to be this bed, showing on the Dark fork 44 inches, and at various points on the Trace fork about 12 inches.

Sections 48 and 49, from Troublesome creek, show the bed but 10 and 18 inches thick, and the stain seen at Allen's, on Lost creek (section 50), was too unpromising to investigate. That at Niece's, farther down the creek, gives indications of a good thickness, with cannel coal reported in it, found in making a grave. On the North fork, near Big branch, where it has been opened by Gough & Co., to 50 feet underground, it was found about 4 feet thick at the entrance, diminished to 42 inches at the head of the entry. It is shown on section 55 as the Haddix coal, but in this entry it is bituminous and splint, while the mines across the river and about two miles below, from which the Haddix coal known in the market was taken, contained a large proportion of cannel coal.

The 58 inches of Russell coal (section 56), and about 5 feet of coal, partly cannel, of the Robert's mine, near the mouth of Fugitt's branch, Troublesome creek, together with other thick outcroppings in the neighborhood, indicate the presence of a large body of coal in this vicinity, with a limit as yet undefined on the north and west. Its existence as cannel coal seems to be rather exceptional.

As the tops of the hills are approached identification of beds becomes more difficult, not only on account of a less extent of outcrop and tiresome ascent in getting to it, but also because the rain and spring waters there do not accumulate sufficient energy to wash out and expose the outcrop, and consequently, especially in this region where most of the land has been occupied but a short time, landholders frequently have not learned even of the existence of these beds, and search must be made without much help from them. This explains a marked reduction in the number of openings recorded of the remaining beds to be described. In the vicinity of Pine mountain their proximity to the limestone ores of that region was the means of establishing their identity.

The lower one of these upper beds, is separated, in the Troublesome creek region, from the bed last described by a massive sandstone, 100 feet thick, which appears in high perpendicular cliffs on nearly every hill, and not unfrequently forms their crests, making a marked feature of the landscape. South of Hazard this prominence of the rock is not observed, and against Pine mountain its character is changed by an admixture of shale, along with which was deposited the limestone ore referred to above.

The coal above the rock has a thickness of 42 inches on Smith branch, Leatherwood creek (section 40), is seen as a heavy stain on the main heads of Leatherwood and of Greasy creeks, and is exposed in a rockhouse at Cornett's, above Hazard, 31 inches thick (section 46). On Troublesome creek, near the Tunnel mill, it is 48 inches thick, and it has been found at Campbell's, about four miles below the mouth of Buckhorn creek, as a heavy stain lying 420 feet above the level of the creek and covered

At Rholley's, on Russell fork, it was discovered 62 inches thick, part splint coal, with two one-inch partings, as shown in section 56. And here it is necessary to state that the apparent increased thickness of strata of this section is to be attributed to their inclination as followed up Russell branch from its mouth to its head. A correct section would then represent the strata of about their ordinary thickness, or approximately as shown in section 55, in which the upper coals correspond with those of

section 56. The 50 inch coal of Big branch belongs then to the bed under discussion, and also the 60 inches of coal of section 54, found on Leatherwood branch of Lost creek. Coal from these openings should be tested for its coking properties.

Comparing the thick coal openings of this bed with the one preceding, a remarkable coincidence is discovered. In both there is a heavy deposit about the heads of Line fork, Leatherwood and Greasy creeks, and again in both on Lower Troublesome creek and its vicinity, extending, however, in the upper bed to a greater distance south on Lost creek and south-east on Troublesome.

The remaining and probably uppermost bed of the region has been found, with two notable exceptions, of little estimation, but, being in part cannel coal and but little explored it is quite probable that some other valuable pockets, at least, may be discovered.

It is recognized as the top-hill cannel bed of section 33, on Turkey creek, and again as the 18 inches bituminous coal of the next section at Isom's, on Line fork. The cannel coal stain of section 38, from Beech fork, appears to have slipped from the bench above, where this coal should be in place, but nothing in the vicinity there indicates a thickness sufficient to induce further search for it. Across the ridge, and about two miles west from this place on Laurel fork of Cutshin creek, is a valuable deposit, which now must be considered as a part of this bed, though requiring determination. It is one of the exceptions alluded to above, and shows at Archibald Cornett's 67 inches of coal, of which 23 inches is a fine cannel, ranking by analysis among the first in the country. A section of the bed is shown in Plate XV. The upper bed of section 43, 25 inches bituminous coal found at Bogg' on Cutshin creek, is also referred to this bed.

Northward from the last named point many of the hills are not high enough to catch the bed, and it has not been identified, excepting in the eighteen-inch coal in the Lot's creek section, until near the mouth of Lost creek, where, on Mill branch, it again appears, but in a slip where its thickness could not readily be ascertained. It is a point where investigation should not be neglected. On Big Branch (section 55) an unfortunate point for

opening the bed seems to have been selected, but eighteen inches of bituminous coal having been discovered, while at the mouth of Lost creek it was found thirty-six inches thick, and former openings in the vicinity, now covered by earth and water, are reported to have about three and a half feet of coal. Within 100 yards of the opening made on Big creek a line of cannel outcrop on the same level proves a sudden change in the character of the coal, and other hill-tops in the vicinity are reported as having an abundant outcropping of cannel, which may reasonably be referred to this bed, and which invites further investigation. The bed is known in the neighborhood as the Flag coal.

The thickest coal yet discovered in this bed in Breathitt county is at Rholley's, on Russell branch (section 56), where forty-five inches of splint coal gives it a decided value, which its height of some 500 feet above Troublesome creek does not diminish to the degree to be expected in this locality, as the greater altitude of the adjacent Flint ridge, compared with the surrounding hills, gives it an ample area for extensive mining.

In the following table are given analyses by Dr. Peter of coal from some of the principal openings which have been referred to. (Detailed sections of the beds at some of these openings are represented in Plates XIV and XV.) The analyses were made from samples taken where practicable from the whole working portion of the bed, excepting that of slickenseit coal, which was from a picked specimen. Inasmuch as most of the openings were not penetrated beyond the outcrop, the samples were frequently mixed to some extent with earth, and the proportion of ash resulting was correspondingly enlarged. Some allowance, therefore, should be made on this account, and to such as were probably most affected in this way an asterisk is affixed in the table to the percentage of ash given. The table is arranged in the order of the beds from the top down, and analyses from the same bed are connected by brackets.

Location	Character of Coke.									
	Sulphur	Ash	Fixed Carbon	Volatile Combustible Matter	Moisture	Specific Gravity	Total Thickness of Coal—Inches			
A. Cornett, Laurel Fork, Leslie Co., top and bottom of bed	1.055	5.90	57.70	34.50	1.80	1.243	67			Spongy.
A. Cornett, Middle Bituminous portion	0.737	6.10	61.24	32.06	1.00	1.243	67			Dense.
A. Cornett, 20 inches canal	0.683	6.90	47.20	45.80	0.60	1.255	67			Dense.
J. Rholley, Russell Br., Breathitt Co.	0.848	11.14*	52.25	32.40	4.20	1.426	62			Dense.
E. Cornett, Kentucky R., Perry Co.	0.670	5.50	57.50	32.50	4.50	1.381	31			Pulverulent.
A. C. Russell, Russell Br., Breathitt Co.	0.875	6.80	53.80	35.00	3.80	1.345	58			Dense.
Gough & Co., Kentucky R., Breathitt Co.	1.808	10.40	53.80	34.06	1.74	1.362	42			Spongy.
F. Combs, Dark Fork, Perry Co.	0.588	10.00*	52.94	31.86	6.20	1.570	44			Pulverulent.
W. Shepard, Oldhouse Br Perry Co., upper 18 in., not included	0.958	12.00*	58.00	28.00	1.40	1.362	70			Dense.
H. Sparkman, Lane Fork, Letcher Co.	0.647	4.20	59.20	33.54	3.00	1.321	62			Dense.
H. Engle, Combs Br., Perry Co., two upper seams	1.316	8.08*	56.14	32.80	3.00	1.356	60			Pulverulent.
H. Engle, bottom of bed	0.849	10.40	56.54	31.56	1.60	1.338	60			Light Spongy.
Mull Mine, Mull Br., Breathitt Co.	0.483	10.20	52.50	35.90	1.40	1.366	24			Spongy.
Head of Leatherwood, Perry Co., Slickensides specimen	0.972	5.60	54.90	38.03	1.44	1.276	29			Dense.
G. W. Noble, Lost Cr., Breathitt Co.	8.156	12.86*	51.90	33.90	1.40	1.383	33			Spongy.
B. F. Grigsby, Lot's Cr., Perry Co., 22 inches canal	0.766	6.00	49.40	44.16	0.44	1.250	44			Dense Spongy.
Combs' Mine, Hazard, Perry Co.	0.794	8.80	61.20	33.50	1.60	1.287	38			Light Spongy.
J. C. Lewis, Cutshin Cr., Leslie Co.	0.065	7.06	59.94	61.00	2.00	1.319	56			Spongy.
I. Pennington, Cutshin Cr., Leslie Co., slate at bottom resembling canal	0.519	30.00	32.06	20.14	2.20	1.595	33			Pulverulent.
Stony Fork of Leatherwood, Perry Co., lower seam	0.978	16.50*	53.90	28.20	1.40	1.798	50			Dense.
Half-Mile Br., Greasy Cr., Harlan Co., thickest three seams	0.725	18.20*	52.00	24.70	5.10	1.505	84			Pulverulent.

Occasional outcroppings of iron ore have been found throughout the area explored, frequently of excellent quality, existing as kidney, block and limestone ore. While generally free from sand and rich in iron, the deposits of the two first-named varieties do not appear to be persistent, and are in too small quantities to merit especial attention. An exception may be made, however, for the ore on Turkey creek, Letcher county, shown in section 33, which bears too close a resemblance to the "little block" ore of the Hanging Rock district to be passed unnoticed.

The same paucity is noted in respect to limestone ore until within a few miles of Pine mountain, but throughout, wherever found, it is particularly rich in lime, and sometimes it is accompanied by limestone. As Pine mountain is approached the deposit of ore increases to a very considerable extent, being found most abundant on the headwaters of Leatherwood and Greasy creeks. As yet it has been looked for only as a means of identification of other beds, but, from the surface indications already seen, it is reasonable to suppose that a fair development will prove it to be of prominent value.

Limestone, so far as known, occurs throughout this region, as in counties northeast of it; only of little thickness in small areas in rather widely separated localities. It is believed, however, that in approaching Pine mountain a heavier and more generally spread deposit may be found lying immediately below the ore to which is given its name. Along Pine mountain the heavy outcrop of sub-conglomerate limestone forming its cliffs, continues as the result of its upheaval and the fault there. From this an unlimited supply of limestone may be drawn.

The bastard limestone boulders, common in the heavy shales of the lower coals above the conglomerate, are rarely met. In much of the region these beds are below drainage, and, where appearing above it, the place of the shales is generally occupied by sandstone. This is especially noticeable along the south side of the Kentucky river in Letcher county, a locality in which only very thin beds of coal occur. A comparison of sections taken there and in other localities, does not show this so prominently as does observation on the ground, where the character of the surface and loose rocks exposed often gives reason for

conclusions as to the kind of covered strata beneath, when their actual positions cannot be accurately defined on the sections.

A thin and very durable layer of flinty limestone, noted at various points north of Hazard and on Lot's and Troublesome creeks, is indicated in sections 48 and 49.

A remarkable deposit of flint, about 30 feet thick, lies on and near the top of Flint ridge, Breathitt county, a high dividing ridge between the tributaries of Troublesome and those of Quicksand creek on the north. From this bed fragments have been washed in great profusion down into the South Quicksand valley, and lie thickly strewn along the bed of the creek for several miles. Though of little economic value, the deposit is not without considerable geological interest, especially if it should prove to be of the same horizon as the black flint at the base of the "Barren Measures" of the Kanawha region of West Virginia, to which position it seems to be at least approximate. In color it varies from black through yellow to nearly white.

Approach to the high ridges separating the headwaters of Line fork, Greasy, Leatherwood and Cutshin creeks is rendered difficult by sandstone of a particularly hard and durable character, which, in many places, covers the ground so thickly with its detritus that wagon-roads have not yet been attempted over it, though probably soon to be made, and even bridle-paths are barely possible. Search for coal among these rocks is tedious and unpromising, though an occasional exposure indicates its presence. Cliffs, so generally associated with such rugged surfaces, are inconspicuous, or altogether wanting, probably for the reason that the streams, being small, do not have power enough to carry off the larger fragments, not easily disintegrated, which are broken from the mass and accumulate and protect it. The smaller stones are washed down and cover the stream-beds for miles below. Where this peculiarity exists, the rock is easily recognized, not only by the roughness of the ground it pervades, but also by the almost impenetrable growth of laurel, which accompanies it, invariably, it may be said.

It seems to be a feature of the locality, extending through the greater part of the measures represented there, rather than belonging to any particular geological horizon. Beginning above the second coal on Greasy creek, near the bottom of the

series, and extending through nearly 300 feet of the measures on that creek, it is continued on the other three streams named from a higher horizon to an additional height of several hundred feet.

Reference has been made in the preceding pages to the salt-well at the mouth of Leatherwood creek, Perry county. Another one at the mouth of Troublesome creek is mentioned by P. N. Moore in his "Report on the Geology of a Section from near Campton, Wolfe County, to the Mouth of Troublesome Creek, Breathitt County." Neither of these wells were in operation in the summer of 1884, though the former was being re-opened at that time. No authentic information regarding them could be gathered at the wells, but it seems probable that the supply of salt obtained from them was unsatisfactory, and that they will be altogether abandoned when the present haul of about sixty miles is no longer necessary. These wells, and one on Goose creek, near Manchester, Clay county, which now supply a large area, indicate the presence of extensive saline beds.

In conclusion, the writer wishes to call attention to the fact that in the study of the coal measures, many supposed means of identification of beds, after closer investigation, are found to be illusive, and have to be abandoned. It still remains possible that further examinations may lead to a considerable alteration of his views regarding the continuity of the beds described. Especially may this be the case in the little explored extreme southern part of this region. But whatever changes in this respect may follow, the fact is established beyond dispute that there are large fields of coal throughout nearly the whole region, which are only awaiting means of transportation to become of great value.

Finally, he wishes to express his obligations, particularly to Judge E. C. Strong, at the mouth of Lost creek, for his aid in the examination of the coal-beds in that vicinity, and to all others by whom he has been assisted.

Analyses made by Prof. Thomas Egleston, of the School of Mines, Columbia College, New York, from Samples Collected by Himself. Published by Permission.

Below are given the analyses of all these coals, from the samples taken, just as they were found on the day they were taken. Some of them are somewhat higher in ash than those given by the Survey, but they show generally remarkably well, both as to ash and sulphur.

The following is a list of the places from which the samples were taken:

- Sample No. 1. P. Duff's Bank, at Compton.
- " " 2. Tyler's Bank, $2\frac{1}{2}$ miles from Compton.
 - " " 3. Bed of the stream, near W. Day, on Frozen Creek.
 - " " 4. Myer's tract, opposite Jackson.
 - " " 5. Cannel Coal, Hargis Bank, mouth of Troublesome Creek.
 - " " 6. Bituminous Coal, Hargis Bank, mouth of Troublesome Creek.
 - " " 7. Upper part of Wolfe's Creek Bed.
 - " " 8. George's Bank, Cannel Coal.
 - " " 9. Lower part of Wolfe's Creek..
 - " " 10. Williams' Bank, Leatherwood Fork of South Fork.
 - " " 11. J. Clemmons' Lower Bank, S. Fork of Quicksand, Cannel Coal.
 - " " 12. J. Clemmons' Upper Bank, S. Fork of Quicksand, Cannel Coal.
 - " " 13. Limonite on J. Clemmons' Land.
 - " " 14. Combe's Bank, Main Quicksand, Rasp Cannel.
 - " " 15. Spencer's Bank, lower Spencer tract, Kentucky River, six miles below Jackson.
 - " " 16. Hobbs' Bank, Elkhorn Coal, $4\frac{1}{2}$ miles from Compton.

ANALYSES OF THE COALS.

No.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
Nature.	Bitum	Bitum	Bitum	Bitum	Can'el	Bitum	Can'el	Bitum	Can'el	Bitum	Can'el	Bitum	Can'el	S. bit.	Bitum	
Water	5.35	5.36	2.41	. . .	2.78	5.27	4.88	1.54	1.50	0.35	2.81	2.30	. . .	2.44	5.64	6.13
Volatile combust.	36.68	38.78	47.02	36.93	48.22	38.00	36.83	45.43	48.72	66.28	39.43	45.60	. . .	44.26	37.72	37.54
Fixed carbon.	50.94	53.25	43.76	50.60	44.24	52.02	51.41	40.14	47.59	29.73	48.22	47.12	. . .	43.48	49.37	53.08
Ash	7.03	2.61	6.81	9.37	4.76	4.71	6.88	12.89	2.09	3.64	9.54	4.98	. . .	9.82	7.27	3.25
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	. . .	100.00	100.00	100.00
Coke.	57.97	55.86	50.57	59.97	49.00	56.73	58.29	53.03	49.68	33.37	57.76	52.10	. . .	53.30	56.64	56.33
Sulphur	3.19	1.00	3.73	3.32	0.78	0.84	0.75	1.74	0.75	0.83	1.24	1.71	. . .	1.21	0.99	0.77
Color of ash	Br'ish Gray.	S'dust Color.	Red'sh Brown	S'dust Color.	S'dust Color.	S'dust Color.	S'dust Color.	White	Light Brown	Light Brown	Gray.	Gray.	. . .	Whit. Brown	S'dust Color.	S'dust Color.

PRELIMINARY REPORT ON THE GEOLOGY OF THE LOWER NORTH FORK, MIDDLE AND SOUTH FORKS, KENTUCKY RIVER.

The work of which this report is a summary, consisted of an extension of the work reported upon last year, and embraced a preliminary survey of that part of the territory not included in those reports comprised in the water-shed of the North and Middle Forks, Kentucky river, down to Lee county (excepting the extreme eastern and western parts of Breathitt county), the western part of Wolfe county as far north as Red river, and the greater part of the South Fork, Kentucky river, water-shed above Owsley county.

Errors in the accompanying map of this region are due to the necessity of making it from inadequate data, much of which consisted of random notes taken in the saddle. Such additional material as could be found in the office of the Survey was also used, but it is remarkable that no map or notes of surveys could be procured which would aid in mapping Clay county, and none but a little detached work in Leslie county was available, excepting the maps of the whole State, on a small scale, and abounding in flagrant errors in their representation of this region.

Because of the lack of a satisfactory map, the one now presented is made to include a larger area, and is drawn in greater detail than is required for this report, in the hope that it may be useful for other purposes, until surveys are made from which may be drawn a correct map of this little known region.*

* Leslie county has an area, roughly determined from this map, of 375 square miles; and of such roads as are passable for an ordinary freight wagon, there are barely 100 miles in the county, the travel being almost exclusively in the saddle or on foot.

A new arrangement of sections adopted is made possible by the certainty with which the lower splint bed is identified in most of them. This bed is, therefore, used as a base, and its elevation arbitrarily assumed at 500 feet in all of them. Where the location of this bed is not clearly ascertained the position of the section, relatively to the others, must be regarded only as suggestive of the probable place it should occupy, to be verified or proven in error when occasion requires. In the description following they are assumed to be in their right places.

The tracing of the beds having been carried down the North Fork, Kentucky river, to a connection with the lower coals and conglomerate again, a satisfactory check upon this work is established, and a return is made in the report to the system of numbering in use in the north-eastern part of the State.

Although the numbers given to some of the individual coal exposures may be, and probably are, incorrect, the main features are given with considerable more confidence than was felt in the report of last year, that work having been verified to some extent by the later work, and additional confirmation of both being gained by a comparison of this region with that of the north-eastern field.

The similarity existing between the two fields may be seen most readily by comparison of sections of the latter with the exhibit given on pages 98 and 99. The table given there is made up from the accompanying sections, and includes, with but few exceptions, all seams of coal shown in them, though where several seams appear to belong together in one bed, they have been so grouped at their average elevation.

A considerable irregularity will be noticed in the table, in the distances apart of the different beds. In western Breathitt, Wolfe and Clay counties this is mostly due to an actual difference of thickness of intervening rocks, while many minor differences throughout the whole region are to be attributed to unknown inclinations of beds between points of observation in the same section, and to variations of barometer due to changes of weather, which frequently occurred without opportunity for discovering and correcting them.

The table and sections probably do not give as favorable an impression of the coal region as it is entitled to, inasmuch as openings made in search of a bed are frequently abandoned on finding a single seam, when a more thorough search, for which time was not available, might have developed the main seam a few feet or even inches below the one found, and of much greater thickness. But so far as could be done this possibility was avoided.

The topography of a considerable part of the region to be described is determined by the position and character of the conglomerate rocks, and in part also by the composition of the rocks overlying them. About the head waters of the Middle Fork, Kentucky river, the hills are steep and high, and composed mostly of sandstone. Proceeding down stream a gradual reduction in height is noticed—with some exceptions—but the predominance of sandstone continues to about the point where the conglomerate makes its first appearance, and there a somewhat abrupt change of the greater part of the rock from sandstone to shale occurs, the hills are more rapidly reduced in height, and are more rounded in form.

On the North Fork this change to shale is very marked, and its line seems to lie close along the dividing ridge between Frozen and Holly creeks on the west, and Frozen creek and Red river tributaries on the north. Southwesterly the line can be followed from the shape of the hills across Breathitt county, and the corner of Owsley into Clay county, crossing Bullskin creek near its mouth; thence up Red Bird and Hector creeks, and to the Forks of Goose creek.

A rapid thinning of the measures accompanies the change in Breathitt and Wolfe counties, and where this is fairly accomplished the height of the hills on the conglomerate varies but little from one hundred and fifty feet. But down below the base of these hills the streams have cut their way in narrow, winding gorges through the conglomerate and strata below, sometimes to a depth of two hundred feet.

Most of the conglomerate of Clay county being easily disintegrated, these gorges are rarely found there, the slope

being continuous with that above. But occasionally a more stubborn rock gives more or less of the cañon characteristic. Manchester, the county seat, is built on such rock, a part of it reaching a height above the creek of one hundred feet; but even there the slopes admit of streets upon them. Below the mouth of Little Goose creek it forms a cliff, "The Lovers' Leap," some seventy feet high, and at intervals on Little Goose creek and on Island and Laurel creeks lesser cliffs have been formed of the same rock.

The dip of the strata continues down the North Fork from Letcher county, slightly exceeding the fall of the stream, to a point near Fish-trap branch, where the "Elkhorn" coal is probably fifty feet below the river. But this refers only to the general inclination, for everywhere the strata lie irregularly in undulations of varied length and height. From Fish-trap branch on down the river a series of such waves are found, giving the strata an average slope, just about equal to that of the river bed, until the mouth of Stray branch is reached, two miles above Jackson, Breathitt county, where the "Elkhorn" coal is at the river level. From this point a continuous rise is observed, which, at the mouth of Bloody creek, Wolfe county, throws the same coal about three hundred feet above the river level. On either side of the North Fork the strata rise, as usual, towards the heads of the tributary streams.

The Middle Fork and its branches, as far down as the Leslie and Perry county line, follow synclinal axes in the same manner, but below that line the main dip of the strata is across the direction of the river and towards the North Fork. Its rate is undetermined, but a comparison of the sections on the two streams will give its approximate amount, as they differ little in their level at opposite points. On the South Fork such an additional rise has taken place as to bring the conglomerate to the surface through its whole length, probably. From the mouth of Red Bird, up Goose creek to Manchester, the rise is slight; thence to the forks of the creek a more rapid fall sinks the conglomerate below drainage, and from the forks south the rocks lie very nearly level.

The table of comparative elevations shows that there are

in the region covered by it no less than sixteen coal beds, to which should be added one other to obtain the full number above the conglomerate. Of these beds, fourteen are of workable thickness, and one other, Coal 4b, will probably be found in pockets suitable for working when more thorough search is made. It is the bed described previously as below the upper splint bed, having some fine exposures on Troublesome creek, Perry county.

Of these seventeen beds eight are in part cannel coal, and openings have been made where the coal is thick enough for profitable working in all of these when suitable means of transportation are provided.

. But two tests of the coal for its coking properties are known to have been made, and from them it is probable that two beds, at least, will furnish excellent coke. While it is quite possible that other beds may be worked for the same purpose, the greater part of the coal is not suitable for it.

Roughly speaking, the proportion of splint coal appears to grow less as the distance north and west from Pine mountain is increased, and also to diminish as the vertical distance from Coal 4, the lower splint bed, increases.

The additional number of beds over those reported a year ago is due mainly to a greater vertical range of rocks having been observed, and in part to the discovery of thick deposits of coal in beds previously seen in thin seams only, and not included in the former enumeration.

Where work of the two years joined, or overlapped, the later work has been confirmatory of the conclusions reached from the earlier, excepting that at the heads of Greasy and Leatherwood creeks, it is now believed, a less inclination and increase of thickness of strata obtains than was at first supposed, throwing the beds higher up in the stratigraphical scale. This will be referred to again in detail.

The accompanying sections have been numbered and arranged in order, as well as possible, to show continuously with last year's work, those farthest up stream coming first. For greater convenience in the description of the beds, an order somewhat the reverse will be adopted.

Coal 1.

This bed in Wolfe and Breathitt counties lies about ten feet above the conglomerate, as estimated by the writer, though put at twenty to fifty feet above it by Mr. P. N. Moore in his report, Part vi, vol. iv., p. 14.* The coal shows a nearly uniform thickness, where found at all, varying between two and three feet. The latter thickness is at its extreme southwestern exposure, on the land of J. S. Hobbs, in a roll where it may be abnormally developed. Owing to the uniform character of the rocks over the conglomerate west of this point, and consequent easy slopes of the hills, its stain is rarely visible, and no other opening in it has been made in this part of the county.

It is reported that the Bear Pen coal, a part of this bed two miles south-west of Campton, was tested for coke, and, in confirmation of the opinion expressed in his report by Mr. Moore, excellent results are said to have been obtained. While there is no reason for doubting this, it is much to be regretted that time was not available for making a test, the results of which could be carefully and authoritatively specified.

The bed has been worked in various places about Campton, and also on Holly creek, where it is known as the "Branch" coal, from the fact that it appears in the beds of many of the small branches there. On main Holly creek it remains above the stream nearly to Mrs. Hollon's, some five miles from the mouth of the creek.

On Frozen creek it is exposed at several places on Mrs. Day's and the neighboring farms. Its stain is seen by the road on Little Frozen creek, and across the hill on the head of Cedar creek, and again at the mouth of Shockey Fork—in all these places with a thickness varying little from thirty inches.

Rising nearly with the main Frozen creek valley it should be found as far up as the mouth of Cope's fork, but above that it is believed to be cut off by a mound of conglomerate

* This difference is attributed to an unequal allowance for pitch of the top of the conglomerate, or, perhaps, to a variance in opinion as to what is its top—a question often difficult to answer in this locality.

deposited above the level of the coal bed at the time of its formation. On Cope's fork no such irregularity appears, but the bed goes below drainage near its mouth.

The rapid pitch of the strata up the river from the mouth of Frozen creek quickly carries the bed into the river. It is probably this bed which shows in the bank opposite Wm. Spencer's house, with only eight inches of coal and three inches parting, though possibly this should be referred to a thin seam above the main bed.

It has not been found elsewhere on the south side of the North Fork, and on the Middle Fork its only known exposure where it can be measured, at Isaac Terry's, on Turkey creek, gives but sixteen inches. Little search for it was made on the Middle Fork, as it is doubtless everywhere thin. It goes under the river somewhere near the mouth of Buck branch.

In Clay county the distance of the bed above the conglomerate is uncertain for want of any distinguishing feature in the top of that rock (the word conglomerate being applied to the formation and not to the constituents of the rock). About Manchester the formation is clearly evident, and at Gen. Garrard's mine the coal appears to lie directly on it, though some few feet of the sandstone underneath may be intervening rock. At the mouth of Bullskin creek the coal shows above forty feet of sandy shale, such as that of the western part of the county, which may, perhaps, be considered as a part of the conglomerate formation. On Laurel creek it is found close above the sandstone, and again, a mile away, with one hundred feet of shale below it.

The bed has been opened in many places in the county, with a somewhat better showing, generally, than in Wolfe and Breathitt counties.

At Mr. Davidson's, three and one-half miles up Bullskin creek, and about thirty feet above it, the coal is thirty-nine inches thick (see Plate XVIII); at the mouth of Little Bullskin creek, close to its bed, twenty-four inches without parting; and on both sides of the South Fork at the old salt works, Ammie P. O., about three feet, also without parting.

On Beech creek near its mouth it has been opened nearly

three feet thick, but the coal was covered when visited, so that it could not be measured. Rising quite rapidly up Laurel creek, at J. L. Hornsby's, one mile up, it reaches its greatest known thickness of forty-five inches; and a mile farther up it is reduced to thirty inches. In other openings, beyond, the coal is said to be thicker again.

Several openings have been made in the bed in the close vicinity of Manchester, but they have been abandoned for thicker coal at a greater distance. At D. W. Roberts' opening, a mile up Horse creek, it is thirty-eight inches thick, and at the mine of Gen. Garrard, on the east side of Goose creek, thirty-one inches thick at the face, where a sample was obtained of which an analysis is given on page 97. Another mine of Gen. Garrard's, on the west side of the creek, is stated by Mr. C. J. Norwood, State Inspector of Mines, to vary in thickness of coal "from twelve to forty-two inches, with an average of thirty-two inches." This mine has been worked more extensively than any other above the Beattyville mines on either fork of the river. It is the only mine in Eastern Kentucky in which trouble from fire-damp has been experienced, and the evil there does not appear to have been great.

Above the forks of Goose creek the bed is below the drainage. On Hector creek the bed shows by the roadside in several places, increasing from six inches, some four miles up, to fifteen inches near the mouth; and near the mouth of Flat creek it shows about two feet of coal in the bed of Red Bird creek.

For a considerable part of Clay county this bed is the only one of value, and, though nowhere remarkably thick, it seems to run with sufficient uniformity to make a large area susceptible to profitable working.

It will be seen that the bed is below the drainage in the greater part of the region under discussion.

Coal 1a.

This bed has been noted at various points in Wolfe county as a cannel coal about four inches thick and thirty feet above Coal 1, in a heavy shale bank containing also

many seams of small calcareous concretions. (At Wm. Burton's, on Upper Devil creek, eleven such seams were counted, none more than four or five inches thick.) Where the coal is thin it is a pure cannel; but it sometimes thickens to a large extent with such an increase of impurities that it remains worthless. Its most remarkable development is at B. T. Spencer's, four miles west of Campton, where it has been opened as cannel coal, but is nothing more than black slate three or four feet thick. Several attempts to work and burn it have been made near Campton, but all were unsuccessful. The bed is a convenience for determining the horizon of others in the county, but is without intrinsic value there.

In Breathitt county, on the North Fork, the bed seems to be wanting, and on the Middle Fork waters it has been recognized in but one place, at Isaac Terry's, Turkey creek, forty-five feet above the exposure of Coal 1, and it has there six inches of cannel coal on fourteen inches bituminous.

In Clay county the bed is generally thin or altogether absent. In sections 98, 99, and 100 it appears, the second bed from the bottom, the opening on Beech creek being the only one of especial note as a workable coal; it is shown in detail on Plate xviii. It will be seen from its analysis given in the table, page 97, that the cannel coal here has an excessive proportion of ash. This results from including a little too great a thickness in the sample taken (and in the measurement of the cannel), the coal changing by hardly perceptible degrees from a good cannel to an unquestionable black slate. A few inches less of the dubious part taken would have given an analysis suitable for a good marketable coal.

Coal 2.

This bed, well known as a valuable cannel bed in more northern counties, has not been found as such on either fork of the Kentucky river. In Wolfe county it is a thin bed lying about sixty feet above Coal 1, generally in a heavy yellow shale.

At Samuel Napier's, a mile above Campton, it is twenty inches thick; at Wm. Burton's it has twenty-four inches of

coal with two partings. This appears to be its maximum thickness in the county, and also in Breathitt county on the North Fork waters. It must go below the river near Jackson, but is above Quicksand creek from John Roark's to Hunting creek, probably.

On the Middle Fork it first assumes importance on Long's creek, near the mouth of which it has been opened about at high water-mark. Here it measures thirty-one inches of coal with a parting of four inches, identical with an exposure a half mile up Squabble creek, Perry county, excepting that the parting is there reduced to one inch.

A remarkably fine wagon-load of coal from an opening of Wm. Blanton's, one and one-half miles up Long's creek, supposed to be in the same bed, was seen by the writer, and a specimen obtained from it for the Frankfort cabinet. The coal is reported thirty-six inches thick, with six inches of parting additional, and its unusually fine appearance warranted an examination, but the opportunity was not afforded.

On Guy's creek, a mile from its mouth, the bed is exposed with but twenty-one inches of coal and two inches parting, underlaid by shale with small calcareous concretions. A covering of about eight feet of black slate extends over the bed from Long's creek to Rush creek. On the latter stream the coal has been worked a little, with a thickness of forty-four inches (Plate xvi), its handsome appearance probably more than compensating for the unusually large amount of sulphur in the upper seam, which its analysis, page 97, discloses.

On the river, a quarter of a mile above Elkhorn creek, it is opened thirty-five inches thick, at a height of seventy feet above the river, and at the mouth of Grassy branch its place is about at the river level. It is reported that coal has been taken from a thick bed in the river below Wilder branch.

Beyond this point it is well beneath the river to above Hyden, appearing again at Bowling's mill, with thirty-two inches of coal and two thin partings, and dropping finally beneath the river there.

In Clay county the distance of the bed from Coal 1 is increased to one hundred or one hundred and twenty.

five feet. It appears at its best at the mine of Mrs. S. A. White's, on the Left Fork, Goose creek, where the coal was used quite extensively for evaporating brine. Near the mouth of the mine the coal measures forty inches, as shown in Plate XVIII; its analysis is given in the table, page 97.

An entry has been driven in the bed at Mr. Woods', a mile below the mouth of Martin's creek, with but about two feet of coal, and about the same amount is developed by several openings on Otter creek, near its mouth. Above this creek the bed soon goes below drainage.

On the right, or Collin's fork, Goose creek, it remains above drainage to near the head of the stream. It is the lowest coal of sections 103 and 104. At James Adams', a half mile below L. A. Byron's, it is thirty-three inches thick, exclusive of a parting of nine inches; and an opening at Isaac Swafford's, near the head of Buzzard creek, supposed to be in the same bed, has thirty-six inches of coal without parting.

In the sections 98, 99 and 100 the bed is shown with twenty-seven to twelve inches of coal, and nowhere in the north-eastern part of the county has it been found any thicker.

Without any definite guide in the matter, but from a general impression derived from passing through the western part of the county, it is presumed that the twenty-seven inches of coal at Wm. Wyatt's, near his house, on the Little Goose creek road, is in Coal 2. This bed is opened also on the head of Hogskin branch of a left fork of Sexton's creek, twenty-one inches thick; and probably also the same at Mrs. Reid's, at the head of Sexton's creek, thirty-one inches of coal.

Coal 3.

From the work that has now been done it is pretty well established that this bed is identical with the "Elkhorn" coal of the Pound Gap region.

In the south-western part of Wolfe county it lies about one hundred and fifty feet above the conglomerate, a distance increased to one hundred and eighty to two hundred feet at the mouth of Frozen creek, Breathitt county.

So far as his investigations carried him, Mr. Moore has accurately described the bed in his "Report on the Geology

of a Section from near Campton, Wolfe County, to the Mouth of Troublesome Creek, Breathitt County," previously referred to, along which section it is a most valuable bed, as its many openings fully attest.

Some additional openings were made in Wolfe county for determining the extent of the thick "Hobbs" coal at the head of Upper Devil creek, and a test of the coking properties of that coal was made. The whole bed at the face of the "Hobbs'" entry, some thirty feet under ground, was measured as follows :

Coal	24"
Shale	7"
Coal	7"
Shale	2"
Coal	12"
Shale	11"
Bone Coal	1"
Coal (approximately,	17"

The lowest seam was measured in water, and was not included in the coking test, because of the difficulty of obtaining coal from it. The whole face had been submerged for a long time, and several days' work was required in order to obtain access to it.

The following analyses by Dr. Peter give the composition of the coal and of the coke made from it:

	COAL.		COKE.		
	A.	B.	a.	b.	b'.
Moisture	4.70	3.40	4.00	3.90	2.96
Volatile combustible matter.	33.56	37.50	1.00	0 50	1.44
Fixed carbon	59.14	55.70	89.20	90.00	91.00
Ash.	2.60	3.40	5.80	5.60	4.60
Sulphur	0.574	0.895	0.505	0.576	0.503

Columns "A" and "B" are from average samples of the upper seam of twenty-four inches and middle portion of nineteen inches respectively. Columns "a," "b," and "b'" are from selected specimens of the best coke obtained from the same respective divisions of the bed, the latter being

from a portion of the splint coal which had not become thoroughly incorporated with the rest of the coke.

The coal is distinguished by a very low percentage of ash, and in the samples analyzed above, it shows rather less sulphur than was obtained from Mr. Moore's sample (see page 18 of his report), due, perhaps, to the long exposure of the later coal to water at the head of the entry. In appearance the coal varies little from the handsome specimens which may be obtained from the ordinary run of openings on the North and Middle Forks, Kentucky river, where the splint and common bituminous coals are interleaved, as is the case at this opening.

The process of coking was carried on in two hive-shaped stone ovens, built with an inside diameter of three feet, and height of about two and a half feet. A door was made at the bottom, by which the draft could be regulated, and an opening about eight inches square was left at the top. Ordinary clay mud was used for binding the stones together and closing all chinks, and when the ovens were finished earth was heaped about them, excepting at the door-way, half way to their tops.

They were then filled with coal from the two parts of the bed, kept separate, and the coal was burned for forty-eight and fifty-two hours. The result would have been more and probably wholly satisfactory had not inexperience led, through fear of overburning, to cutting off the draft soon after the fire was started. Nevertheless, in the centers of the masses of partly burned and somewhat smoked coke was found some that was sound and good, had a slightly metallic ring, and was fairly strong. Compared with the "Elkhorn" coke, as given by Professor Crandall in his "Report on the Pound Gap Region," page 21, this coke has rather the advantage in the matter of ash and of sulphur, and falls but little behind in fixed carbon.

The analysis "*b'*," from splint coal, goes to show that such coal makes a higher grade of coke, as far as its constituents determine it, than the common coking coal, but it has not sufficient tendency to agglutinate to make a satisfactory coke. Probably a judicious mixture of the two classes of coal would be most advantageous.

The promise of a large amount of coal held out by the "Hobbs" opening is not realized, as far as area of thick coal in that locality is concerned. Though a considerable amount may be won from the hill in which the main opening is made, no other such exhibit has been found. In an opening on the other side of the gap, less than a quarter mile away, the bed has the following section :

Coal	9''
Shale	2''
Coal	2''
Shale	8''
Coal	12''

Towards Campton it does not diminish as rapidly. At Wm. Tyler's, about a mile in that direction, its section is:

Coal	2''
Clay	13''
Coal	11''
Shale	2''
Coal	2''
Shale	2''
Coal	12''

It has been opened again on the same branch, above Tyler's house; but the opening was abandoned, and no other opening has been made in that direction. At A. M. Swango's, Stillwater creek, it shows a good stain, not opened.

Directly over the hill from the "Hobbs" opening, towards Holly creek, the bed appears to be cut out by sandstone, all excepting one seam six to eighteen inches thick. Near Poplar Gap, Upper Devil creek, on the land of J. M. Cockerham, it was opened with a section measuring

Coal	9''
Shale	4''
Coal	2''
Shale	7''
Coal	8''

with five inches of coal about ten feet above it. Various openings were made on the head of Hunting Fork, Holly creek, in search of it, but all were in thin coal which was not fully identified. At Jonathan Elkins', on Hunting Fork, the coal is probably eighteen inches thick. (Section 88.)

Of the many openings along the river from Bloody creek to Jackson, where the bed is known as the "River Hill" coal, all are now abandoned, pending improved means of transportation. From the report of Mr. Moore and information gathered on the ground, they run generally with from two and one-half to three and one-half feet of coal and a parting of from two to twelve inches. A new opening made in the course of this investigation at Mrs. Day's, near the mouth of Frozen creek, gave thirty-six inches of coal without parting.

But the impression first received from visiting these openings of a continuous body of thick coal is erroneous. In this bed, as in all others of the whole region covered by this report, and by that of last year under the same hand, no predictions can be made with any degree of certainty on the thickness of coal at any particular locality. But irregular as the deposits are, the sum of the areas of thick coal developed is enormous, beyond present calculation, and sufficient to warrant and repay large outlays carefully directed, but likely to lead to loss if full investigation follows, instead of precedes, the construction of extensive works.

Further, it should be remarked, that, in general, it has not been considered within the scope of this investigation to determine the bounds of thick coal in any particular locality, but rather to obtain a comprehensive view of a large area, and at the same time record all details as should come within the range of observation.

In the bed under discussion, an example of the uncertainty noted above is seen at A. C. Bowman's, on the river, two miles below Jackson. Here, on the south side of the river, an entry was driven a considerable distance into the hill before working coal was found; only the knowledge of its presence on the opposite side of the hill leading to persistent work. On the north side of the river the coal is exposed in a number of thin, irregular seams, in one of which a part of it is excellent cannel coal.

Above and below, on the river, the coal lies thick, while on either side, beyond those mentioned, such exposures as have been found are thin, or the bed is broken up into several widely separated seams.

Such is its condition on Big Pan Bowl branch, as shown by the lowest three seams of section 82, the Bowman cannell coal being there diminished to two inches; and a like separation exists where the bed has been found on the upper part of Frozen creek, though an approach of the seams is discovered on its main head. By J. R. Wilson's house two of them are ten feet apart, the lowest ones of section 86, and a mile above but three feet apart, and twenty-seven and seventeen inches thick without any parting. A mile further up the creek they are separated twelve feet, the upper seam with twenty-nine inches of coal having partings of two and twelve inches, the lower seam with the same thickness of coal and a parting one-half inch thick.

At G. W. Johnson's, Stillwater Fork, but one seam was found, twenty-seven inches thick.

About a mile up either fork of Cane creek, near the level of the streams, exposures of the bed exhibit the same variation, with a total thickness of twenty-one and thirty inches. On Stray branch the separation shown in the cliff at its mouth increases until the seams disappear beneath the creek.

On Quicksand creek, a half mile from its mouth, the bed, uncovered at low water, has twenty-five inches of coal and three thin partings; at John Roark's, three miles up the creek and eighty feet above it, the thickest seam has nineteen inches of coal (see section 81); from outcroppings on the creek, as far up as Hunting creek, no working coal is apparent.

From Quicksand creek to Troublesome the bed rises and falls along the bed of the river, and furnished without mining a considerable supply for local consumption; but it will not admit of extensive working there. Nor does it show to advantage in the region above up to Carr's Fork, Perry county, as developed in the report of last year, and further shown by its exposure in thin seams along the river between George's branch and Lot's creek. (See also the lowest coals of sections 80 and 79.)

On the waters of Middle Fork it is first recognized on Puncheon Camp creek, three miles from its mouth, one seam a foot thick. At Granville Spicer's, below Canoe Fork, are

two seams, ten feet apart, with thirty-four inches of coal (section 78), and on Canoe Fork it shows about the same. So far as known to the writer, no exposure of the bed has been seen anywhere between Canoe Fork and Grassy branch, Perry county. It is quite possible that it may yet be found of good thickness, but the interest existent in that neighborhood when coal was marketed from there, quite as likely would have led to its discovery.

On Grassy branch and on Hell-for-Certain and Bull creeks, Leslie county, it is thin and broken up; but at the Asher entry, two miles below Hyden, it is massed almost into one seam with fifty-three inches of coal. (Plate XVIII.) Several openings have been made about Hyden and the coal found about three feet thick, the upper one of them, on Hurst branch, measuring:

Coal	27"
Shale	2"
Coal	8"

At John Bowling's the bed has but twenty-three inches of coal divided by four partings, but at Hughes Morgan's, or Saltwell branch, it reaches a thickness of fifty-nine inches of coal. (See Plate XVII and section 69, Plate XXII.)

The fifteen inches of coal at the bottom of section 68 is supposed to represent an upper seam of the bed, going underneath the Middle Fork near the mouth of White Oak branch. On Beech Fork it is probably not less than eighty feet below drainage, at the mouth of Oldhouse branch, but it rises again further up, to sink below finally about at the Harlan county line, with a thickness of but eighteen inches in the seam showing there.

Three miles up from its mouth, at Elias Howard's, on Greasy creek, the bed shows but thirty-one inches of coal, thirty feet above the level of the creek; at the mouth of Honey branch it is about sixty feet below drainage, and it probably continues at about that depth up to the mouth of Lewis branch, though at the mouth of Abner's branch it is thirty-five feet above the creek. It is the lowest coal of section 42 of last year's report, in which it is wrongly referred to a lower bed. Excepting this error, and also that the Coal

3a, now distinguished as a separate bed, is there sometimes included as an upper seam of the lower bed, the description of the "Elkhorn" coal, now determined to be Coal 3, is believed to be correct, and should be consulted for the region east of that now described.

In Clay county only a few openings have been made which can be referred to this bed, which here lies about two hundred and fifty feet above Coal 1. Sections 98 and 99, on Bullskin and Hector creeks, show a seam with seventeen and sixteen inches of coal. On Upper Double creek (section 96) there is but twelve inches. The bed shows at its best in the county at J. T. Smith's, Tom's branch, Red Bird creek, with thirty-five inches of coal; the lower five inches cannel coal. (See Plate xviii, and section 102, Plate xxx, and for analyses page 97.)

On Collins' Fork, and perhaps for all the western part of the county, the distance of the bed from Coal 1 is probably somewhat less than given above. At L. A. Byron's (section 103) it has about three feet of coal cut up by partings. At Mrs. Hopper's, in Knox county (section 104), but twenty-two inches without parting, increased to twenty-six inches of very slaty cannel coal a quarter mile up Bull creek. At T. Jones', two miles up the same stream, the bed has the following section:

Cannel coal, inclined to splint	15"
Bituminous coal.	1" to 4"
Limestone concretions	3" to 0"
Bituminous coal	7"

Coal 3a.

This bed varies in distance from Coal 3 from thirty-five feet on Hunting Fork, Holly creek, where alone it has been identified in Wolfe county, to one hundred and twenty feet on Collins' Fork, Goose creek, Clay county. Its usual distance is about sixty feet.

It is ordinarily a thin coal without value, but it has one pocket, at least, of excellent cannel coal, lying about eighty feet above Quicksand creek opposite and below John Roark's. Numerous openings have been made in this deposit, and considerable coal taken from it, but now they are all abandoned

and generally covered up. At one of them the following measurements were obtained:

Bituminous coal	18''
Cannel coal	18''

a thickness somewhat less than has been given in other reports. It is stated that unsuccessful search for working coal has been made in the neighboring hills, and that the old workings are nearly exhausted.

The bed is identified back of John Roark's as the eleven inches of coal of section 81, and opposite Jackson (section 83) it is in two thin seams.

For other points in Breathitt, Perry and Leslie counties, it is sufficient to refer to the table of elevations, pages 98 and 99, as the bed is uniformly thin, excepting where split up into many seams as shown in section 70, the third bed from the bottom, and in the lowest bed of section 93; and also as found at Henry Chappell's, a quarter mile up Elk branch, Greasy creek, where thirty-seven inches of coal has four partings. It should be noted also that it occurs again as cannel coal at the mouth of White Oak branch, Middle Fork, Leslie county, and that where indicated as lying close to the bed above it, it might be, perhaps, correctly included as a lower seam of the upper bed, instead of assuming it to constitute a bed in itself.

In Clay county its presence is shown in various sections; but with a thickness rarely exceeding eight inches, it is only necessary for present purposes that the fact be stated.

Coal 4.

This bed, from previous investigation determined to be the chief one of a considerable part of the drainage area of the North and Middle Forks, continues to hold this distinction over much of the region now under consideration. Heretofore it has been designated on the above streams as the "lower splint" bed, and as Coal 4 it is most widely known as the Hunnewell cannel of Greenup county. In many other localities in North-eastern Kentucky the bed carries cannel coal, and though the same is not infrequently present in it in this newly explored region, it retains, throughout, its general character as a splint coal bed.

In Leslie county the bed is generally divided and strongly marked by a parting of non-plastic fire-clay from one inch to eight inches thick, a peculiarity extending into some of the adjoining counties, and even through Perry into Letcher county, and rendering the identification of the bed particularly easy and sure.

On account of this, and because it is rarely wanting in the sections made, this bed is taken as a base in grouping the sections in the plates, the scale of each plate of sections being placed to indicate this bed at an elevation of five hundred feet.

The bed in Wolfe county lies fifty to eighty feet above Coal 3, too high to be found in most of the hills south-west of Campton. At A. M. Swango's, on Stillwater creek, it is an excellent coal without parting and thirty-four inches thick. At Jonathan Elkins', on Hunting Fork, Holly creek, it has been opened in front of his house with about six feet of coal and shale, measuring in its upper part:

Coal	6"
Shale	5"
Coal	2"
Shale	3"
Coal	5"
Shale	15"

The lower part is said to have one thin parting and two good seams of coal, but it was covered so that it could not be measured. Below and back of his house two abandoned openings are reported as having twenty-seven and thirty-six inches of coal and a parting about two inches thick.*

Other exposures in the southern and western parts of the county, which have been identified, show the bed only with thin coal. It is found as cannel coal, seven inches thick, at

*The measurements of coals of section 88 are given as reported by Mr. Elkins, who has done considerable towards developing the coals in his neighborhood. He is confident that the above openings are in the "River Hill" or No. 3 Coal bed, on account of the resemblance of the coals, and because of their thickness and partings being similar to those of openings of the latter along the river. The writer's conclusions are based on the distance of the bed above the conglomerate (determined by the four inches of cannel, Coal 1a), on its distance from the out-crop near the top of the hill, which can hardly fail of being Coal 5, and on the number of intermediate beds.

the head of Red river on the Hunting creek road, and reports of other cannel outcrops between that and Campton are referred to this and the two beds next above.

On Frozen creek, Breathitt county, it is uniformly thin, and sometimes separated into several seams, only the twenty inches of good cannel coal at James Cope's, on Davis' branch, giving promise of a workable bed. On Cane creek, a mile from the Markham Branch Gap, it has twenty-one inches of coal and nine inches of shale in two partings. Near the head of Stray branch it is a splint and semi-cannel bed sixteen inches thick. Near the mouth of Markham branch it is opened under the name of "Coal Harbor" coal, thirty-five inches thick, with a parting of one inch.

Two miles above Markham branch the bed has increased to six or seven feet, in an old opening where it could not be measured, and from that point for two or three miles farther, on the north side of the river, it appears to hold to a thickness of thirty to thirty-six inches with some regularity. On the south side of the river it has been found only in thin seams, between Markham's and George's branches. On George's branch is the cannel coal (Plate xv) described in the report preceding this, now established almost with certainty as belonging to this bed.*

The numerous entries along the branch, and absence of any on adjacent branches, is indicative of a closely limited pocket of thick coal. An abundant outcrop of cannel coal is found, however, on the head of Lick branch nearest George's branch, and on Wolfe creek another enlargement of the bed has occurred. This is seen at openings about a mile from the river, where the coal reaches a thickness of eighty-eight inches without parting, the lowest twenty-seven inches closely resembling the curly cannel coal of the Haddix mines in a higher bed. An analysis of the whole thickness is given in the table, page 97. Such unusual thickness in this bed cannot be expected to hold through any great distance, and a considerable reduction is reported on either side of this

*The somewhat singular statement is made of this coal, that all that is mined from the east side of the branch is so explosive that it can be marketed only with some difficulty, and at a lower price than that taken from the west side, which burns quietly and without flying from the grate

main opening within one hundred yards. It is scarcely possible, however, that an ample quantity for working should not be found.

Continuing up the North Fork no further knowledge of this bed is obtained until Caney creek is reached, near the mouth of which, at John Deacon's, was discovered forty-two inches of coal, the lowest nine inches being cannel coal (Plate xv), and this is probably not the full thickness of the bed, as the opening was made in the point of a hill down which the coal pitched and had wasted to some extent. Analyses of the two seams of the bed are given in the table.

Crossing the hill from Caney creek to the river above, the coal is found again at Cardwell's, probably somewhat under three feet thick, and again a mile up Grapevine creek, Perry county, at John Spencer's, where it is said to be three feet thick ; but it was so covered that but twenty inches of coal could be seen. On Thomas Johnson's land, two miles up Ebersole branch, the bed is first found to contain the fire-clay parting previously alluded to, and having here a thickness of but one inch. The fifty-seven inches of coal opened, of which twenty inches is splint coal, is represented in Plate xvi, and its analysis is given in the table of analyses. A half mile down the branch it is opened fifty-five inches thick. Its development on this stream, taken in connection with that on Guy's creek, yet to be described, augurs exceedingly well for this locality.

As shown by its exposure a half mile up Henson's branch, the bed has changed its character very much in that distance, its section there being as follows :

Coal	4''
Shale	1''
Coal	16''
Fire-clay	4''
Coal	7''
Shale	1''
Coal	2''
Shale	2''
Black slate	5''
Cannel coal	9''
Black slate	7''

Near the mouth of Rock Lick branch are two exposures, nearly alike, in which the coal is concentrated again and is somewhat thicker than as given above. One of them is shown in Plate xvi, and an analysis of the coal is given in the table. (See also the lowest coal of section 78.)

Its next exposure, on Willard creek, near its mouth, has the following section:

Coal	2"
Fire-clay	4"
Coal	10"
Clay	4"
Coal	6"
Black slate	3"

At Samuel Whitaker's, near the head of the creek, the upper seam is entirely gone, and below the fire-clay is but one seam of coal fifteen inches thick.

Again the coal has increased to a good working thickness on the river four to five miles below Hazard. Among other entries, abandoned for the time, one of Alexander Combs' has thirty-seven inches of coal in sight, and it is said that a lower seam of the bed is present (under the fire-clay) which has not been worked; the other now partly covered openings indicate it. In more extensive mining there is no reason why both seams should not be made use of.

Points farther up the North Fork have been treated in the report preceding this, but to them may now be added the twenty-one inches of coal found on Big creek, and shown near the bottom of section 58; the fifty-seven inches of Woolrey Campbell's, on Mace's creek (Plate xvi), and the twenty-two inches coal of section 57.

On that part of Middle Fork and its tributaries in Breathitt county, the bed has not been found of workable thickness, its best exposure being at Crawford's on Beginning branch, where it occurs as a cannel coal eighteen inches thick. The analysis given in the table of a picked specimen of this coal shows it to be of rather ordinary quality. The specimen was selected, however, on account of a peculiar stain of iron peroxide, which banded one of the layers of cannel blocks, and not as representing the best of the coal.

Exposures on Puncheon Camp creek, Canoe Fork, and at Granville Spicer's (section 76) have only thin bituminous coal. At Turner's, on Lick branch (above Turner's creek), a promising stain was brought to the surface by a slip, under which the solid coal lies deeply hidden.

A quarter mile above the mouth of Squabble creek, in Perry county, the bed first appears as a workable coal. Its one opening belonging to Peter Gross, lying at a height of two hundred and eighty-five feet above the river, has thirty-six inches of coal without parting, measured at the face of the entry some twenty-five yards underground. This coal is of remarkably fine appearance: a dull black, hard and strong, and nearly uniform coal, a part of it almost without visible lines of lamination. By general report of the neighborhood it is the finest bituminous coal that has been sent down the Middle Fork, and it brought an advanced price in the market. Reason for this report is readily seen in its analysis (page 96), giving but 3.10 per cent. of ash, while in other respects it stands well up among good coals.

At the mouth of Guy's creek the fire-clay again appears in the bed, parting forty-eight inches of coal; and two miles up the creek a total thickness of forty-seven inches was measured, probably including fire-clay, though it was not noticed. That at the mouth of the creek was hard and black, scarcely distinguishable from coal, excepting on fracture. Taking these openings in connection with those on Ebersole branch, North Fork, their close resemblance almost justifies a prediction of constant working thickness nearly from one river to the other.

But farther up the Middle Fork, as on the North Fork, the bed becomes thin, sections 74 and 73 showing but eight and ten inches of coal; on Bull creek an increase to twenty-eight inches is noted, and about Hyden the bed has been found with only thick coal over a large area. This is represented by detailed sections as follows: Wm. Sisemore's coal, Rockhouse creek, Plate XVIII; John Lewis', on Hurst branch, J. C. Brewer's and Reuben Magyard's, Cutshin creek, on Plate XVI, to which should also be added J. C. Lewis' fifty-six inches of coal on Cutshin creek, and on Plate XVII.

John Bowling's and Jesse Morgan's coals, on Middle Fork, and on Burnt Camp branch above Hyden. (For analyses, see the table, page 96.)

Near the head of Rockhouse creek the bed is reduced to twenty-four inches, that part of it under the fire clay having wholly disappeared, and, though absent at one opening on Hal's Fork, Big creek, as shown in section 97, at two others near by it is present, but with a thickness of four inches only. At these two openings the seam over the fire-clay is fifty-three inches thick. (See Pleasant Sisemore coal, Plate xviii.)

Above the mouth of Greasy creek, on Middle Fork, and on Beech Fork, the bed as yet found is too much cut up by partings to attain to the value it has below that creek. It appears probable that the bed above approaches so near to it that the two become indistinguishable, though the attempt is made to describe them separately. The sections of Plate xxi show this conjunction (of Coal 4, on the 500 feet level, with the bed above it), those of Oldhouse branch and of the head of Middle Fork giving fair working coals.

The bed goes under Middle Fork close above the mouth of Spruce Pine creek, and under Beech Fork near Chumley rock, a cliff of local renown but not unusual height, at the mouth of the branch of the same name.

On Greasy creek the bed is exposed in one seam twenty-four inches thick on the fire-clay, at Elias Howard's on Lick branch, and again on Honey branch (section 64) with four inches of coal below the clay, which here has lost its usual hardness and color, due to iron and bitumen, and has become soft and white.

On and above Laurel Fork, Greasy creek, another unbroken series of thick openings has been developed. On Laurel Fork the least thickness found of the bed is on Fed's (or Fred's) branch, thirty-four inches of coal and six inches of fire-clay parting. On Upper and Lower Double branches openings give seventy-three and forty inches of coal respectively, the former represented in Plate xvii.

On White Oak creek the bed has forty inches of coal, and on Lewis branch, Greasy creek, forty-four inches (Plate

xvii), its single parting of fire-clay comparatively harmless; but on Abner's branch, Greasy creek, the accumulation of seams with eighty-four inches of coal, the lowest part of which belongs to this bed, is so separated by partings as to make it worthless for a long time. (See second coal of section 42 of last year's report.)

At Christopher Lewis', on Wolf creek, the bed is exposed with fourteen inches of coal on the fire-clay, as in section 60, while a neighboring sandstone cliff shows the bed to be completely cut out at that point.

On the waters of the South Fork, besides the openings on Big creek, Leslie county, already mentioned, there is but one other locality where the bed has been found favorable for working. There it is represented by two openings about a quarter mile below the mouth of Indian Grave branch, Left Fork, Goose creek, Clay county; its thickness in one of them fifty-one inches without parting, and in the other forty-six inches and two thin partings. At the Lewis entry, opposite the mouth of Asher Fork, it is reduced to twenty-nine inches without parting.

On Philips Fork, Red Bird creek, Leslie county, besides the thirty inches given in section 93, the bed was found a mile above Elisha Morgan's house with eleven inches of cannel coal, overlaid by eight inches bituminous.

For other openings in Clay county attributed to this bed reference may be had to the sections of Plates xxviii, xxix and xxx, and coals at the indicated elevation of 500 feet. Excepting on Hector creek, the distinctive fire-clay has not been found west of Red Bird creek, and there it forms the floor of the bed.

West of Goose creek and its Collins Fork the bed has not been recognized, but, with its elevation of some 400 feet above the conglomerate, it can be found only in the tops of the highest hills, excepting those about the head waters of Collins Fork, where the conglomerate is far below drainage.

Coal 4a.

This bed lies generally from fifteen to thirty feet above Coal 4, but is sometimes much closer to it, coming, doubtless,

into actual contact in some places, and consequently exhibiting there an unusual thickness. It is clearly impossible to distinguish always between the two.

Though found as a cannel coal at one place only, heretofore, on Troublesome creek, it is now developed as such at various points in the region under discussion.

In southern and western Wolfe county the bed is either wholly absent, or it has been included under Coal 4.

On Stillwater Fork, Frozen creek, Breathitt county, the handsome cannel coal of G. W. Johnson's, described by Mr. Moore, was found to be only eleven inches thick, but the same bed on a branch above G. W. Johnson's house has blocks of double that thickness projecting from the outcrop.

At John Roark's, on Quicksand creek, and on either side of John D. Strong's, on the north side of the river, the bed is found with about thirty inches of coal. On Grapevine creek, Perry county (if not belonging to the bed below, from which it is separated by but five feet of shale and clay), it is thirty-five inches thick (Plate xvi and section 79), and on Ebersole branch, North Fork, with a somewhat increased distance from the lower seam, forty-six inches, of which the lowest eleven inches is cannel coal. (Plate xvi.) Beyond this point its outcrop has not been identified on the North Fork below Lot's creek.

On the Middle Fork, appearing first on Squabble creek, it assumes thence a rather more definite position. On Squabble creek it is found as a cannel coal, thin at the place opened (see section 75), but, from the thickness of blocks seen at an old opening a mile from the mouth of Squabble creek, near the path to Long's creek, it is apparent that a part, at least, of the cannel slate of the section is there replaced by good cannel coal.

Along the Middle Fork up to White Oak branch the bed appears only in thin coal, as shown in sections 73 and 69, and on Wilder branch as an eight inches cannel coal seam in the midst of massive sandstone.

At the mouth of White Oak branch it is made prominent with fifty inches of coal, though its parting of over three

feet impairs its value greatly. On Beech Fork, however, at the mouth of Oldhouse branch, its thirty-eight inches of good cannel coal gives it a value elsewhere unattained. Its analysis is given on page 96. This seam of cannel coal may, perhaps, belong to the bed, Coal 4, to which it lies close, as shown in section 66; it is, doubtless, the same seam as the thirty-five inches bituminous in the lowest coal of section 67. While the latter can hardly be treated as a separate bed, the former is given a distinctive character by the quality of its coal.

At all other points in Leslie county the bed has been found only with thin coal. (See sections 59, 60, 61 and 65.)

In Clay county the bed appears quite constantly, varying in distance from Coal 4 from ten feet on Upper Double and Katy's creeks to seventy feet on Tom's branch, Left Fork, Goose creek. Nowhere in the county a cannel coal, and ranging in thickness generally from fifteen to twenty inches, with its maximum thickness, thirty-two inches, on Hector creek, Lick Fork and Red Bird creek.

Coal 4b.

This coal lies from thirty feet above Coal 4 in Wolfe county (unless it is there mistaken for Coal 4a), to 90 and even 125 feet above it in Clay county.

It has not been found anywhere in the region of workable thickness, though what were supposed to be small pockets of thick coal in the bed were found in the region covered by the report of last year; nor has it anywhere appeared as a cannel coal. Places where it has been found are indicated in the accompanying table, and the corresponding sections furnish a guide for its further identification.

Coal 5.

At a height of 80 to 120 feet above Coal 4, with exceptions in Clay county, lies the coal, well known in Breathitt county as the Haddix coal, designated in recent reports on the North Fork, Kentucky river, as the upper splint coal. Until recently only suspected to be the equivalent of Coal 5 of the north-

eastern part of the State, it is now determined to be so without reasonable doubt.

Occurring as a cannel coal in the region now described only in Wolfe and Breathitt counties, its frequent appearance as such, its excellent quality and occasional great thickness, coupled with the difficulty experienced in reaching the solid bed, gives it a peculiar interest there.

This difficulty is probably due to a thick stratum of clay accompanying the coal, giving rise to frequent unusually heavy earth slides from above, which cover the coal and sometimes serve to mark its approximate position. Such a slide has taken place at the head of a hollow in front of Jonathan Elkins' house, Hunting Fork, Holly creek, Wolfe county, estimated to measure 400 feet along the hill by 50 feet on its slope, and a similar slip has occurred at the same elevation behind the house.

At A. M. Swango's, Stillwater creek, cannel coal blocks were found in earth through a distance of twenty-five to thirty feet, search being then abandoned, with the bed supposed to be about two feet thick. Reports elsewhere in the county of random blocks of cannel coal slipping out of the hillsides indicate a nearer constant cannel field than its regular outcroppings can prove.

Even with the steeper hills and greater proportion of sandstone in Breathitt county this tendency to slip is very marked, and caused the discovery of the original Haddix coal, from the face of which its covering was entirely stripped. It is not unlikely that other such deposits may be brought to light in the same way, though the usual effect is to hide them more deeply.

The bituminous stain of the coal is found near the top of the hill at the mouth of Frozen creek, and cannel coal at the head of Stillwater Fork, but neither has been opened. On Cope's Fork, Frozen creek (section 84), the bed exposes but six inches of coal, but it is probable that a search there would discover more. At Wilson's, on the main head of the creek (section 86), the bed is broken up by partings, the lowest four inches cannel coal, but near by, at Green Taulbee's, on Clear Fork, a single seam, without parting, measures forty-two

inches, the lower half being a semi-cannel coal; and again farther up the main creek, the bed is thirty-six inches thick.

The discovery of a bed, confidently believed to be the same, mainly splint coal, forty-eight inches or more thick, at Isaac Back's, on the head of Middle Fork, Licking river, Magoffin county, should lead to its early development in this locality. Should the bed hold good under the high ridge on which the three counties corner, means of communication by tunnel between the Licking and Kentucky rivers may be easily obtained.

Across the river from William Spencer's, and also from Jackson, cannel coal has been reported, but it has not been seen by the writer; the bituminous stain of the bed shows in the gap on the road from Jackson to Cane creek. A well-defined bench on the level of the bed may be seen almost anywhere in Breathitt county south and west of Jackson, but no openings are known to have been made nearer than the vicinity of the mouth of Troublesome creek, where the Haddix coal is mined. This coal is described by Mr. Moore in his report, elsewhere referred to. His section of the bed at the Sewell mine is given on Plate xv.

On Hayes' branch, Troublesome creek, an abandoned opening gives a thickness of two feet or more, and other outcrops farther up the creek show a rich field in that direction, as indicated in the report of last year.

Above Troublesome creek, besides the forty-two inches of section 55 (last year's report), a recent discovery has been made at Marion Spicer's, on Lick branch, North Fork, sixty-one inches of coal without parting; but efforts to open it elsewhere in this neighborhood have resulted unsuccessfully. On the road from Caney creek to Leatherwood branch cannel coal may be seen in a slip where the bed can only be reached with much labor. The only other opening to be mentioned on the North Fork waters is on Mace's creek, Perry county, where a thickness of coal and shale of thirty-five inches was found, with another seam (or bed) twenty feet below.

On the Middle Fork waters the first appearance of the bed is at Berry Turner's, on Ground Hog branch, Long's creek, with fifty-nine inches of coal much injured by partings (Plate

xv, and analysis, page 96), after which, though found at many points along the river (sections 75 to 63), no further thick deposit has been discovered nearer than the base of Pine mountain.

The fifty-five inches, part slikensides coal, at Adrian Metcalf's, on Greasy creek, Harlan county, reported last year as probably belonging to the lower splint bed, is now, from additional data obtained, referred to the upper splint bed, though further work is yet necessary to determine it satisfactorily. Its relation to higher beds is shown in section 62. Another exposure at the forks of Laurel Fork, Greasy creek, evidently in the same bed, has thirty-nine inches of slikensides coal without parting.

In Clay county the bed is as represented in the sections of Plate xxviii, and in section 102, Plate xxx, nowhere of importance to require especial remark.

Coal 6.

Varying within quite narrow limits, the average distance of this bed from Coal 5, as found from the table of elevations, is about sixty feet.

With a horizon barely cutting the tops of the highest hills of the southern part of Wolfe county, it can be found of considerable area in that county only in the high dividing ridge between Red river and Hunting creek, where no search for it has been made.

In Breathitt county it is opened only at Granville Spicer's, below Canoe Fork, Middle Fork. In his entries, now inaccessible, is reported twenty inches thickness of cannel coal, and six or eight inches bituminous. Some hundreds of bushels of the cannel coal mined have been left exposed on the hill for years, yet it looks perfectly fresh and good, some blocks measuring eighteen inches thick. In quality it appears remarkably fine, having some resemblance to the "curly" Haddix coal (and there is a possibility that it may be ultimately identified with that bed, with a corresponding reduction of the others of section 76), and a part of it showing a change in individual pieces from pure cannel coal to a semi-cannel, like that of Coal 4, on Wolf creek.

On Howard branch, North Fork, it has a promising stain never opened, but other stains seen in the county indicated only thin coal.

At Elijah Davidson's, three miles up Grapevine creek, Perry county, the bed was measured as follows :

Bituminous coal	3''
Clay	4''
Bituminous coal	5''
Rather slaty cannel coal	8''

At John Spencer's, on the same creek, it has fifty-two inches bituminous coal (see section 79 and Plate xvi, and analysis, page 96), but it appears again as cannel coal, twenty-two inches thick, at Samuel Whittaker's, Willard creek. (Section 77.)

The bed has been found at various points on the Middle Fork above Breathitt county (sections 75 to 63), but at only one of them with cannel coal. This is in the river hill a mile below Rush creek, Perry county, where it is ten inches thick and inclosed by twenty-four inches bituminous coal. The only other point at which it was found suitable for working is at G. W. Hoskins', Beech Fork, Middle Fork, Leslie county, forty-four inches of coal. (Section 65 and Plate xvii.)

In Clay county, also, one opening of good thickness has been found (forty inches, Plate xviii, and analysis, page 96), at Alvis Hubbard's, on Katy's creek. Other openings in the same county show its usual occurrence there as a thin bed. Pieces of cannel coal on the ridge between Big Double and Little creeks are the only evidence of its being a cannel coal yet found in the county.

As in Wolfe county, its horizon overreaches the tops of a large proportion of the hills.

Coal 7.

This bed lies from 200 to 300 feet above Coal 4, its distance increasing towards Pine mountain probably with more regularity than is shown by the table of elevations. Its distance from Coal 6 ranges by that table from thirty to seventy feet.

At J. R. Wilson's, on Frozen creek, Breathitt county, the

stain of the bed has been opened over three feet thick in the top of a spur where no solid coal could be had; a better result could be obtained from the adjoining hill.

It is believed that the thirty-nine inches opening of J. Wells', near the mouth of Troublesome creek, described by Mr. Moore, and represented in Plate xv, is in this bed; it is similar to one of sixty inches on the head of Leatherwood branch, Lost creek, reported a year ago (Plate xiv), and of which an analysis is now given in the table, page 96.

Another opening, on John Little's branch, North Fork, gave only nineteen inches of coal, but, having been made in the point of a hill, its full thickness may not have been obtained. On the river side of the hill, on the road from Caney creek up the river, is a heavy stain of the bed, but it is badly slipped.

Above Rock Lick branch, Perry county, the bed was opened with thirty-six inches of coal without parting, reduced to thirty inches some twenty yards under ground. (Section 78.) On Willard creek it was found thirty-two inches thick, and on Big creek, at Alfred Ebersole's, it has sixty-two inches of coal with but two inches parting. (Section 58 and Plate xvi.)

Undiscovered on the Middle Fork, in Breathitt and Perry counties, in Leslie county the bed occurs with some regularity, so far as it has been explored, as a thin bed only.

In Clay county the bed has not yet been opened of working thickness, but a heavy stain near the top of the high ridge between Bullskin and Red Bird creeks, of which the elevation was not obtained, is thought to belong to it.

Coal 8.

This bed, generally about forty-five feet above Coal 7, is the one known about the mouth of Troublesome creek, Breathitt county, as the Flag coal, and described as such in the report of last year. Indications had been found there then of a valuable cannel field or pocket, which later investigations have more fully confirmed.

The greatest development of cannel coal in the bed is in the ridge between the North Fork and Lost creek. Open-

ings near the heads of the branches named below gave the following measurements :

	Mill.	Leatherwood.*	John Little's.*	Lick.
Cannel slate		4''		
Bituminous coal			12''	
Shale			2''	
Bituminous coal	8''	3''	17''	8''
Shale	2''	3''	2''	11'' (clay)
Bituminous coal	25''	27''	6''	10''
Cannel coal	14''	13'' (bitum. c.)	11''	12''

The Lick branch opening is on the south side of the river, the others on the north, and all in the region above the mouth of Troublesome creek. The bottom coal of the Leatherwood branch opening is in detached blocks, similar to those of the cannel coal. The bituminous stain of the bed was found, but not opened, at various other points in this part of the county.

In Perry county an opening, now covered, at Alfred Eber-sole's, Big creek, shows that a very good cannel coal was found there, and a thickness of two or three feet or more is indicated. At the head of Mace's creek but thirteen inches bituminous coal was found.

Other openings of the bed in this county, never before re-ported, are included in the following table:

	John Spencer's, Grapevine Cr.	Pigeon Roost Branch	S. Whitaker's, Willard Creek, 1/4 mile below house	S. Whitaker's, Willard Creek, 1 mile above house	Alex. Combs', North Fork, below Hazard .
Cannel slate			4''	6''	
Clay			6''	6''	
Bituminous coal	23''			9'' (can. sl.)	
Shale	2''			3''	
Bituminous coal	17''	60'' +	48''	45''	39''

* Prior to making this opening several attempts to reach this bed were made, on account of the profusion of cannel blocks which mark its outcrop, by those living in the neighborhood; but all efforts were thwarted by masses of rock which had fallen from above, crushed through the coal, and entirely separated the outcrop from its bed. So it had come to be believed that the outcrop all around the hill was no evi-dence of a bed of coal extending through it. A similar experience being had by the writer at the above openings, the triumph of the spectator was great—but brief, as the coal was soon found immediately behind the rock.

Slips having caused partial covering of the Willard creek openings before measurements were taken, they are approximate only, but are substantially correct. The thick seam at the bottom of the bed is generally part splint coal, and sometimes a large proportion of it is of this kind.

Analyses of coals from some of the more important openings are given in the table of analyses.

What openings were made in Leslie county disclosed a thin bed, excepting on Wolf and White Oak creeks. On the former it has thirty-seven inches of coal, as in section 50; on the latter it was opened in several places, and its changes and relation to the bed, or seams of coal under it (Coal 7), are exhibited below. Openings in the same seam are placed in line horizontally, the upper group alone representing Coal 8:

At C. K. York's, White Oak Cr'k.	$\frac{3}{4}$ mile up Right Fork from J. Turner's.	$\frac{1}{4}$ mile up Rig't Fork from J. Turner's.	$\frac{1}{4}$ mile up Left F'k from J. Turner's.
$\left\{ \begin{array}{l} \text{Shale. . . } 3'' + \\ \text{Coal . . . } 3'' \\ \text{Shale . } 35'' \\ \text{Coal . . . } 9'' \end{array} \right.$	$\left\{ \begin{array}{l} \text{Shale } 4'' + \\ \text{Coal } 3'' \\ \text{Shale } 9'' \\ \text{Coal } 9'' \\ \text{Clay.} \end{array} \right.$	$\left\{ \begin{array}{l} \text{Coal stain.} \end{array} \right.$	$\left\{ \begin{array}{l} \text{Shale . . . } 90'' + \\ \text{Coal } 2'' \\ \text{Shale, iron o. } 10'' \\ \text{Splint coal . } 36'' \\ \text{Clay.} \end{array} \right.$
$45' \left\{ \begin{array}{l} 35' \text{ covered.} \\ 5' \text{ sandstone.} \\ 4' \text{ shale.} \\ 1' \text{ sandstone.} \end{array} \right.$	$20' \left\{ \begin{array}{l} \text{Covered.} \end{array} \right.$	$20' \left\{ \begin{array}{l} \text{Covered.} \end{array} \right.$	
Bitum. coal . . 19''	Bitum. coal 14''	Bit. c. & can. sl . 9''	
$8' \left\{ \begin{array}{l} \text{Covered.} \\ \text{Shale.} \end{array} \right.$	$9' \left\{ \begin{array}{l} \text{Shale. } 8'' \\ \text{Covered.} \\ 2' + \text{ yellow shale.} \end{array} \right.$	$9' \left\{ \begin{array}{l} \text{Covered.} \\ 2' \text{ yellow shale.} \end{array} \right.$	
$\left\{ \begin{array}{l} \text{Coal } 1'' \\ \text{Shale . . . } 12'' \\ \text{Splint coal . } 15'' \end{array} \right.$	$\left\{ \begin{array}{l} \text{Coal } 8'' \\ \text{Shale } 2'' \\ \text{Splint coal . . . } 4'' \end{array} \right.$	$\left\{ \begin{array}{l} \text{Block bit. c. . } 11'' \end{array} \right.$	

A considerable upward pitch of the beds on the Right Fork, towards Old Roan creek; would have led to a misconception of their number and position had they not been examined carefully.

The single opening in this bed in Clay county, on Katy's

creek (the upper bed of section 95), gives little intimation of what it may develop, though it is too high to be found of sufficient area for working elsewhere in the county than near the head of Red Bird creek and of the Left Fork, Goose creek.

It may well be remarked, as indicative of the lack of development of nearly the whole region, and particularly of the higher beds, that all but three or four of the openings in this bed named above were opened last year under the direction of the Survey.

Coal 9.

The few openings that have been made into this bed show it well worth a more thorough search. Fifty to seventy-five feet above Coal 8 it lies on the top of a hard sandstone and below much softer rock, so that a very broad bench is often formed, which marks the place of the coal distinctly, but serves for hiding it effectually.

Its place in Breathitt county appears to be not far below the top of the high peak at the heads of Frozen and Hunting creeks and Red river. Cutting only the highest peaks to the south-east, it should still have a working area in Flint ridge, but it has never been looked for there. Its only opening in the county is on Markham branch, North Fork, where its thickness, not fully obtained, is more than three feet.

At Abner Campbell's, on Fish-trap branch, Perry county, the bed has its greatest thickness, fifty-six inches without parting, of which the lower half is a fine splint coal, and the whole of excellent quality.

On Hell-for-Certain creek, Leslie county, its bench is distinct, but its stain gives no indication of its thickness. On White Oak creek but fourteen inches of coal was found; but at Wesley McFadden's, on Hal's Fork, Big creek, the bed has sixty-one inches of coal, as shown in Plate XVIII.

Analyses of the thick coals of this bed are given in the table, page 96.

On Lick Fork, Red Bird creek, Bell county, the bed has twenty-one inches of coal. In Clay county it has not yet been found.

Coal 10.

Sixty-five to ninety feet above Coal 9 is another bed, which, though high in the hills, carries sometimes sufficient coal to give it considerable importance. Though having some little cannel coal in it, not enough has been found to increase its value materially.

The bed probably overreaches all the hills of Breathitt county. In Perry county its place is marked by a prominent bench near the tops of the highest hills, indicated in sections 79 and 77. At the head of Fish-trap branch its stain is found; but no opening in the coal has been made lower down the North Fork than Big creek.

At John Fields', on that stream, it was opened, measured, and the lower part sampled by James J. Profitt, soon after which the opening caved in. His measurements (sixty-one inches of coal, including six inches of cannel) are given in Plate xvi, and the analysis of his sample with others in the table.

At Mace's creek, the only other opening of the bed on the North Fork waters, the coal was found thin.

On the Middle Fork, in Leslie county, the bed runs from twelve to twenty-nine inches thick as found along its main course, but on Beech Fork it is found again with about five feet of coal, on Oldhouse and Reuben branches. (Sections 66 and 65 and Plate xvii, and for analyses, page 96)

At points of sections on the waters of Greasy and Cutshin creeks the bed was found in each instance, but no working seam developed; it is quite possible, however, that the one at Magyard's, on Cutshin creek, which was imperfectly opened, might give a better result if fairly developed; and also that at Metcalf's (section 62), in which some of the five partings are likely to disappear in working to solid coal, the opening having been carried barely far enough to distinguish coal from shale, and none other showing such an intermixture.

The bed has not been found in Clay county; but just across the line, in Bell county, on Lick Fork, Red Bird creek, it has in its several seams a thickness of over four feet—a strong inducement for further search in that vicinity. It is the top bed of section 94.

Coal 11.

In the high hills about the heads of Greasy creek, Harlan and Leslie counties, about 200 feet above Coal 10, lies a body of thick coal shown in sections 61, 62 and 63, which for present purposes may be called Coal 11, though it is not unlikely that some intermediate bed may yet be found, which, eventually, will take this number, and scarcely probable that at any time can these upper beds be fully identified with those of the north-eastern part of the State.

The bed has its greatest thickness of coal, eighty-three inches, at the head of Pace Trace, White Oak creek, but its area is confined to a narrow limit in the top of a high ridge. On Upper Double branch the hills are much higher, and, though much injured by partings, the sixty-four inches of coal there will in time become valuable. (See for these openings Plate xvii, and also analyses.) On Gill branch, Laurel Fork, Harlan county, but forty-one inches of coal was seen in an imperfect opening, which, perhaps, might have developed more.

Other openings in this bed were made at the head of Middle Fork and on Harmon branch (sections 67 and 69), the former with a thickness of forty-two inches, the latter with but nineteen inches of coal.

Coal 12.

No opening has been made into this bed, and its stain has been seen only at Nicholas Schell's, on Upper Double branch (section 63), where it lies forty feet above Coal 11. It is probably from two to four feet thick there.

Coals Excluded from the Table of Elevations.

In section 70 is a seventeen inches seam of coal lying thirty feet above the lowest coal of the section. This may be an offshoot from the bed below, or, perhaps, more likely, should be called Coal 2a, but as no equivalent to it appears elsewhere in the region, it is preferred to omit it in the table as a local interpolation.

Again, in section 69, a seam thirty-five feet below the highest bed there, having twenty-one inches of coal, has no

place in the table for a like reason. Its distances from the seams above and below are large for its consideration as attached to them, and are correct, the three seams being exposed directly above one another.

Coals below the top of the conglomerate are

Inter and Sub-Conglomerate Coals.

These beds reach the surface only in the western part of Wolfe and Clay counties, and are not known to be of workable thickness in either county. Sections 91 and 92 show their positions in Wolfe county at the mouth of Clifty creek and on Lower Devil creek, as nearly as could be ascertained in the short time allotted to them.

Exposed in the cliff opposite the mouth of Clifty creek there are two thin coal seams in the shale which separates the two sandstones of the conglomerate there, and two or three seams between the bottom of the lower conglomerate sandstone and the top of the limestone below it. The bed reported in the river at the mouth of this creek, two or three feet thick, is the only one which has any probable value.

On Chimney-top creek this bed appears to be absent, only an eighteen inches seam being found, five to ten feet below the lower conglomerate sandstone, which here is but fifty feet above the limestone. This seam probably corresponds with the fifteen inches seam of section 92.

On Lower Devil creek a coal appears from under the stream between Whistman's mill and the ford below.*

It is said, also, that coal has been found in the inter-conglomerate shale there, as found near Clifty creek.

It is probable that the deep-cutting streams of this southwestern part of the county expose many miles of outcrop of the bed, three to five feet thick, mined at Beattyville; but as yet no such thickness has been discovered.

In Clay county no attempt was made to find any of these beds. It is not likely that the lower ones reach the surface, and the upper ones are, doubtless, inconsiderable. An eight inches seam, supposed to be about fifty feet below the top of the conglomerate, showing on the Little Goose creek road about five miles from Manchester, is the only one seen by the writer.

On the following pages are tables of analyses of some of the principal coals and of the comparative elevations of beds previously explained and referred to. Samples were averaged in the usual manner, excepting some cannels, which have been specified:

*Permission to open this bed was refused by Mr. Whistman.

ANALYSES OF COALS BY DR. R. PETER, Chemist of the Kentucky Geological Survey.

Designation of Bed	LOCATION.	Total thickness of coal—Inches . .	Specific gravity	Moisture	Volatile combustible matter	Fixed carbon	Ash	Sulphur	Character of coke
11	N. Schell's, Upper Double Branch, Leslie county	64	1.363	1.72	35.68	62.60	*11.40	1.367	Light spongy.
11	Pace Trace, White Oak creek, Leslie county (lower 53'')	83	1.509	9.40	32.20	58.40	*9.60	0.483	Pulverulent.
10	John Fields', Big creek, Perry county	61	1.383	3.50	35.30	61.20	*8.06	1.035	Dense.
10	Dale Bledsoe's, Reuben Branch, Harlan county	63	..	1.60	33.30	65.10	*15.40	1.491	Dense spongy.
10	Silas Nantz's, Oldhouse Branch, Leslie county	46	1.502	1.30	32.36	66.34	*16.00	1.409	Dense spongy.
9	Abner Campbell's, Fish-trap Branch, Perry county	56	1.359	5.26	30.34	64.40	9.20	0.475	Friable.
9	Wm. McFadden's, Hal's Fork, Leslie county	61	1.322	1.60	34.94	63.46	*8.00	1.066	Dense spongy.
8	Alex. Combs', below Hazard, North Fork, Perry county	39	1.290	1.76	36.04	62.20	6.00	0.557	Light spongy.
8	Samuel Whittaker's, Willard creek, Perry county	45	1.390	3.96	32.84	63.20	*10.40	0.722	Friable.
8	John Spencer's, Grapevine creek, Perry co. (lower 48'')	52	1.366	4.36	30.34	65.30	10.40	0.450	Friable.
8	Gough & Co.'s, John Little Br., Breathitt co. (middle seam)	46	1.410	7.40	30.20	62.40	*10.36	0.621	Pulverulent.
8	Gough & Co.'s, John Little Branch, Breathitt co. (cannel)	46	1.177	1.20	58.80	45.00	5.54	0.722	Dense.
8	Head of Leatherwood Branch, Breathitt county	43	1.384	2.80	31.16	66.04	*12.70	0.690	Dense.
7	Head of Leatherwood Branch, Breathitt county	60	..	9.60	29.46	60.94	*16.80	0.478	Pulverulent.
6	John Spencer's, Grapevine creek, Perry county	40	..	6.48	30.32	63.20	*15.40	0.491	Pulverulent.
6	Middle Fork, below Rush Branch, Perry co. (cannel 10'')	34	..	0.80	44.80	54.40	16.80	0.970	Pulverulent.
6	Alvis Hubbard's, Katy's creek, Clay county	38	1.290	1.60	34.28	64.12	*9.30	1.766	Dense spongy.
5	B. Turner's, Long's creek, Breathitt county (lower 30'')	59	1.275	2.00	35.36	62.64	*5.28	1.019	Light spongy.
5	Green Taulbee's, Clear Fork, Breathitt county	42	1.310	3.80	34.40	61.80	10.00	0.585	Dense.
4a	J. Ledington's, mouth Oldhouse Br., Leslie co. (cannel)	38	..	1.10	44.20	54.70	*11.00	0.690	Dense.
4	Lewis' Branch, Greasy creek, Leslie county	44	1.251	1.72	35.02	63.26	*5.68	0.599	Light spongy.
4	Mc. C. Schell's, Upper Double Branch, Leslie county	73	1.342	3.20	29.70	67.10	*9.60	0.626	Dense.
4	Jesse Morgan's, Burnt Camp Branch, Leslie county	65	1.291	0.70	34.70	64.60	*9.40	0.988	Spongy.
4	Wm. Sizemore's, Rockhouse creek, Leslie co. (upper 63'')	69	1.279	0.74	36.06	63.20	9.20	1.807	Spongy.
4	Mouth of Guy's creek, Perry county (upper 32'')	48	1.366	3.40	31.00	65.60	*10.80	0.557	Friable.
4	Peter Gross, mouth of Squabble creek, Perry county	36	1.259	1.90	37.10	61.00	8.10	0.749	Spongy.

4	J. Campbell's, mouth of Rock Lick Branch, Perry co. . .	39	. . .	2.80	29.60	67.60	*9.10	0.505	Friable.
4	Thos. Johnson's, Elersole Branch, Perry county . . .	45	1.834	3.30	34.90	61.80	*9.60	0.763	Friable.
4	J. Deacon's, Caney creek, Breathitt co. (lower 27" bit.)	42	. . .	3.80	32.30	63.90	*15.10	0.840	Pulverulent.
4	J. Deacon's, Caney creek, Breathitt county (cannel 9")	42	. . .	0.80	41.70	57.50	*24.20	0.952	Pulverulent.
4	J. Deacon's, Wolf creek, Breathitt county . . .	88	1.351	2.80	33.60	63.60	9.40	0.695	Dense.
4	Crawford's, Beginning Branch, Breathitt co. (cannel)	18	1.274	1.00	41.10	57.90	11.20	1.120	Dense.
4	I. Jackson's, mouth of Indian Grave Branch, Clay co. .	51	1.288	1.10	35.60	63.30	*6.40	0.885	Light spongy.
4	R. Collins', Hal's Fork, Big creek, Leslie county . .	57	1.285	1.40	35.68	62.92	*4.00	0.667	Light spongy.
8	J. T. Smith's, Tom's Branch, Clay co. (bituminous 30")	35	. . .	2.80	29.40	67.80	10.80	1.178	Dense friable.
3	J. T. Smith's, Tom's Branch, Clay county (cannel 5")	35	1.160	0.30	44.16	55.54	11.80	1.244	. . . . .
2	Wm. Bowling's, Rush creek, Perry county (upper 20")	44	1.279	1.20	39.60	59.20	6.50	1.327	Spongy.
2	Wm. Bowling's, Rush creek, Perry county (lower 20")	44	1.300	1.20	35.90	62.90	7.60	0.654	Light spongy.
2	Mrs. S. A. White's, Left Fork, Goose creek, Clay county	39	1.278	1.48	35.92	62.60	7.90	0.885	Light spongy.
1a	J. M. Jones', Beech creek, Clay county (bituminous 32")	47	1.313	0.92	37.54	61.54	*8.10	1.601	Light spongy.
1a	J. M. Jones', Beech creek, Clay county (cannel 15")	47	. . .	0.42	32.38	67.20	*32.00	6.042	Dense.
1	T. T. Garrard's, east side of Goose creek, Clay county	31	1.287	1.20	38.10	60.70	5.80	1.793	Light spongy.
1	J. L. Hornsby's, Laurel creek, Clay county	45	1.292	1.46	34.84	63.70	6.00	0.531	Light spongy.

- Muddy outcrop sample.

GEOL. SURV. 1-7

TABLE SHOWING RELATIVE ELEVATIONS OF BEDS.

Compiled from Accompanying Sections.

Sec. No.	LOCATION.	Initial of county..	Coal 1	Coal 1a	Coal 2	Coal 3	Coal 3a	Coal 4	Coal 4a	Coal 4b	Coal 5	Limestone.
57	Mace's creek	P.	.	.	.	.	.	500	.	.	610	I. ore.
58	Big creek	P.	.	.	.	.	.	500	.	580	.	.
59	Cutshin creek	L.	.	.	.	.	445	500	530	.	605	.
60	Wolf creek	L.	.	.	.	.	.	500	515	560	625	.
61	White Oak creek	L.	.	.	.	.	.	500	515	555	.	.
62	Laurel Fork	H.	.	.	.	.	.	.	.	.	595	.
63	Upper Double Branch	L.	.	.	.	.	.	500	.	.	590	Fossil.
64	Honey Branch	L.	.	.	.	.	465	500	.	.	595	.
65	Beech Fork	L. & H.	.	.	.	395	480	500	510	.	.	.
66	Oldhouse Branch	L.	.	.	.	.	490	500	525	570	.	.
67	Head of Middle Fork	L.	.	.	.	.	.	500	.	.	.	.
68	White Oak Branch	L.	.	.	.	405	*440	500	535	.	.	.
69	Saltwell Branch	L.	.	.	.	400	.	500	535	.	.	.
70	Middle Fork above Hyden	L.	.	.	805	435	485	500	.	550	625	.
71	Rockhouse creek	L.	.	.	.	.	.	500	.	.	585	.
72	Bull creek	L.	.	.	.	390	.	500	.	585	610	.
73	Hell-for-Certain creek	L.	.	.	.	400	.	500	525	550	590	.
74	Grassy Branch	L. & P.	.	.	.	400	.	500	.	.	570	.
75	Squabble creek	P.	.	240	.	.	.	500	*525	.	580	.
76	Canoe Fork	Br.	.	305	.	395	460	500	.	.	590	.
77	Willard creek	P.	.	.	.	.	440	500	.	.	.	.
78	Fish-trap Branch	P.	.	.	.	.	455	500	.	.	.	.
79	Grapevine creek	P.	.	.	.	390	.	500	510	585	.	.
80	Lick Branch	Br.	.	.	.	405	450	500	.	555	595	.
81	Quicksand creek	Br.	.	.	295	360	*430	500	525	.	595	640
82	Big Pan Bowl Branch	Br.	.	.	.	370	.	500	.	.	610	.
83	Jackson	Br.	.	.	.	360	415	500	.	670	*620	.
84	Cope's Fork	Br.	.	.	315	360	415	500	515	.	580	605

85	Mouth of Frozen creek	Br.	215	.	.	.	270	400	420	.	.	.	580	.	.	.
86	Head Frozen creek	Br.	.	.	.	.	.	445	.	500	.	.	*585	.	.	645
87	Stillwater Fork	Br.	.	.	.	.	365	430	450	500	.	.	*605	.	.	635
88	Holly creek	Br. & W.	.	.	.	825	.	420	465	500	.	.	*590	.	.	.
89	Stillwater creek	W.	.	.	.	.	395	455	.	500	.	.	*590	.	.	615
90	Campton	W.	.	.	.	325	385	450	.	500	.	.	.	.	.	.
91	Lower Devil creek	W.	} These sections show coals below top of conglomerate only.													
92	Mouth of Clifty creek	W.														
93	Phillips Fork	L.	.	.	.	.	.	.	450	*500	.	.	605	.	.	.
94	Lick Fork	C. & Bl.	.	.	.	.	.	.	415	500	530	.	580	.	.	.
95	Katy's creek	C.	.	.	.	.	.	.	.	500	510	550	630	.	.	.
96	Upper Double creek	C.	.	.	.	.	.	315	370	500	510	590	685	.	.	.
97	Hal's Fork	L.	.	.	.	.	.	.	410	500	530	.	.	.	.	.
98	Bullskin creek	C.	75	.	165	.	225	325	.	500	515	.	.	.	.	.
99	Hector creek	C.	105	.	.	.	240	365	.	500	515	.	.	.	.	.
100	Beech creek	C.	115	.	*160	.	215	.	405	.	.	.	.	.	.	.
101	Indian Grave Branch	C.	.	.	.	.	.	.	.	*500	535	590	.	.	.	.
102	Tom's Branch	C.	.	.	.	.	.	*840	.	500	570	625	665	.	.	700
103	Collins' Fork	C.	.	.	.	.	250	345	465	.	.	625	.	.	.	.
104	Collins' Fork	K.	.	.	.	.	260	*320	390	500	.	.	.	.	.	.

* Cannel coal. Bold-faced type denote a thickness of coal of three feet or more in the vicinity of the section.

TABLE SHOWING RELATIVE ELEVATIONS OF BEDS.—Continued.

Sec. No.	LOCATION.	Initial of county.	Coal 6.	Coal 7.	Coal 8.	Coal 9.	Iron ore.	Coal 10.	Coal 11.	Coal 12.	Iron ore.
57	Mace's creek	P.		800	850			1000			
58	Big creek	P.		775	*815			*970			
59	Cutshin creek	L.		750	780			910			
60	Wolf creek	L.	670	780	810		L. ore.	*925			
61	White Oak creek	L.		745	795	860		930	1130		1200
62	Laurel Fork	H.		735				920	1130		1340
63	Upper Double Branch	L.	635			910			1220	1260	1820
64	Honey Branch	L.	650	790	860			950			
65	Beech Fork	L. & H.	660	810	880			980			
66	Oldhouse Branch	L.	670		865			985			
67	Head of Middle Fork	L.	655					925	1105		
68	White Oak Branch	L.			850						
69	Saltwell Branch	L.	695					975	1055		
70	Middle Fork above Hyden	L.		725	800						
71	Rockhouse creek	L.		700				910			
72	Bull creek	L.		705							
73	Hell-for-Certain creek	L.	655	710	†	880		975			
74	Grassy Branch	L. & P.		700							
75	Squabble creek	P.	645								
76	Canoe Fork	Br.	*645								
77	Willard creek	P.	*660	725	790			970			
78	Fish-trap Branch	P.		735		845		900			
79	Grapevine creek	P.	*690		800	855		895			
80	Lick Branch	Br.	685		*760	†					
81	Quicksand creek	Br.									
82	Big Pan Bowl Branch	Br.									
83	Jackson	Br.									
84	Cope's Fork	Br.									
85	Mouth of Frozen creek	Br.									
86	Head Frozen creek	Br.		725			950				

[illegible]

* Channel coal. † Black fossiliferous limestone at elevation 845. Iron ore at elevation about 790. Bold-faced type denote a thickness of coal of three feet or more in the vicinity of the section.

Recapitulation.

From the foregoing details the following prominent features of the various beds in the region discussed are extracted:

Sub and inter-conglomerate coals reach the surface only in south-western Wolfe, and, possibly, Clay counties. So far as found they are without economic value.*

Coal 1 has a large area developed in Wolfe county and lower Breathitt, on the North Fork, ranging from two to three feet in thickness. It is the least variable of all the beds; is an excellent bituminous coal with some splint, and promises, unlike its equivalent farther north, to become an important coking coal.

In Clay county the coal is much used for local consumption on Goose creek, where it is two and a half to three feet thick, but it gives no indication of possessing coking qualities.

Coal 1a is a thin cannel coal in Wolfe county, without working value. Elsewhere it occurs only as a thin bituminous coal, excepting on Beech creek, Clay county, where there is about one foot of cannel overlaid by two and a half feet of bituminous coal.

Coal 2 is not found as a cannel, and carries but little splint coal. It reaches a thickness of over two and a half feet on Long's creek, where it is an exceptionally fine coal, and will probably become an important working bed along the Middle Fork in Perry county, where it reaches a thickness of over three and a half feet.

In Clay county its single thick opening on Left Fork, Goose creek, promises well for that vicinity only.

Coal 3, the "Elkhorn" coal, is found as a superior coking coal in a thick pocket in Wolfe county. It is found as a cannel coal in Breathitt county, but in thin seams only. An extensive field of coal, three and a half to four and a half feet thick, probably also suited for coking, has been well developed along the North Fork from Bloody creek to Stray branch. Another hardly less important field, with a thickness reaching up to five feet of coal, is found on the Middle Fork extending from below Hyden, Leslie county, nearly to

*The main sub-conglomerate, or Three Forks coal, is below the surface in the region described.

the mouth of Beech Fork. These fields are somewhat interrupted by areas of thin coal, probably small.

In Clay county the bed again carries a thin seam of cannel coal, and this can be profitably worked on Left Fork, Goose creek. Evidence is found pointing to the extension of this field as bituminous coal only, through from one fork of Goose creek to the other.

Coal 3a is generally a thin bituminous coal, with occasional pockets of cannel, one of which has been considerably worked near the mouth of Quicksand creek, Breathitt county.

Coal 4, the most important bed, is the "lower splint" of previous reports, sometimes a cannel coal. In Leslie county, and parts of counties adjoining, it is conspicuously marked by a persistent thin parting of non-plastic fire-clay, on account of which it is made the base in grouping sections at an assumed elevation of 500 feet.

Working seams are found in the southern part of Wolfe county, but they appear to be limited to pockets.

Above the mouth of Troublesome creek, Breathitt county, frequent openings show an immense area of coal, varying from two and a half to over seven feet in thickness, and containing pockets of cannel coal of good thickness and quality. Thick deposits are found along the North Fork nearly through Perry county, and one is believed to extend from the North Fork across Middle Fork—on Ebersole branch and Guy's creek, and down to Squabble creek, where it yields the purest bituminous coal of the region.

Another larger, and still more promising field—favorable in the more uniformly thick coal found—extends in Leslie county from Rockhouse creek, up the Middle Fork and Cutshin creek to the points at which the bed disappears below those streams, and nearly the full length of Greasy creek. Of the many openings made in it scarcely any give a thickness of coal of less than three feet.

On the waters of South Fork the coal is generally thin, exceptional thick deposits lying near the heads of Big creek, Leslie county, and Left Fork, Goose creek, Clay county, which are not unlikely to prove of considerable extent.

Coal 4a carries cannel coal over a greater area than any of

the other beds, but, where of workable thickness, the cannel is probably still in pockets. It lies frequently so near Coal 4 that both beds are made more valuable thereby, and it appears that they are sometimes in contact.

In lower Breathitt it has been developed as a cannel coal without the discovery of any thick deposit. Its openings of nearly three and four feet, on Grapevine creek and Ebersole branch, North Fork, alone indicate a considerable working field in that part of Perry county: the latter thickness includes eleven inches of cannel coal.

Near the head of Middle Fork and on Beech Fork, Leslie county, it again becomes prominent, with over four feet of bituminous coal on the former stream, and thirty-eight inches cannel on the latter.

Coal 4b has been found only in thin seams, though its previous discovery as thick coal, elsewhere, leads to the expectation of finding similar deposits in this region.

Coal 5, the "upper splint," is another important bed, containing cannel in Wolfe and Breathitt counties.

Near the head of Frozen creek, Breathitt county, it is three to three and a half feet thick, part splint and semi-cannel coal, and probably over four feet thick across the hill in Magoffin county. About the mouth of Troublesome creek is an irregular field with coal from three and a half to five feet thick, including the Haddix coal with its three feet of fine cannel. Unusual difficulty in opening the bed has undoubtedly prevented finding much other valuable cannel coal in this vicinity. A five feet opening on Long's creek probably marks the south-western limit of the field.

Along the base of Pine mountain, Harlan county, it is three to four and a half feet thick, slickensides coal, as shown by exposures at the forks of Laurel Fork and of Greasy creek.

Coal 6 is frequently in part cannel coal, but as yet has been found with a workable seam of it only on the Middle Fork below Rush creek, Perry county. Scattering openings made in bituminous coal, three to five feet thick, show it to be of some importance; these are on Grapevine creek, Perry county; Beech Fork, Middle Fork, Leslie county, and Katy's creek, Clay county.

Coal 7 is of working thickness on the head of Frozen creek, Breathitt county, and over a considerable area about the mouth of Troublesome creek openings have discovered a field, with five feet maximum thickness, which may extend to the Perry county line. Thick coal is found also in Perry county on the North Fork above Rock Lick branch, and on Big creek; and in Clay county probably on Bullskin creek.

Coal 8, above the mouth of Troublesome creek, is an important cannel bed four feet thick, with about one foot cannel. Along the North Fork, in Perry county, openings indicate a constant thickness of three to five feet. In Leslie county, three feet on Wolfe and White Oak creeks gives some promise of a considerable field there.

Coal 9 has but few openings, of which the principal are: Markham branch, North Fork, Breathitt county, three feet; Fish-trap branch, North Fork, Perry county, four and a half feet, and Big creek, Leslie county, five feet.

Coal 10 has five feet of coal on Big creek, Perry county, and on Reuben and Oldhouse branches, Beech Fork, Leslie county. Probably an excellent working bed will be developed in Kentucky ridge in Harlan and Bell counties, and in its northward spurs.

Coal 11 has seven feet of coal at the head of White Oak creek, Leslie county, but it has sufficient area for working only on the south side of Greasy creek, where it is five feet thick on Laurel Fork and three and a half feet on the head of Middle Fork.

Coal 12 has been found, but has not been investigated.

Iron Ore.

Of the iron ore in the region under discussion that about the head waters of the Middle Fork, in Leslie and Harlan counties, alone appears to be in abundant quantity. Some intimation of this was given in the report of last year, and though still imperfectly developed there, it is now ascertained almost beyond question that the ore will compare favorably, in quantity and quality, with most of the furnace regions of North-eastern Kentucky. The valuable ores all lie above Coal 5, as seen in the accompanying sections, are

generally calcareous, apparently rich in iron and free from silica. Diminishing in quantity northward, their limit may be considered reached at the Leslie and Perry county line, and on the west at the ridge between Middle Fork and Red Bird creek.

There are, however, numerous smaller deposits in Perry and Breathitt counties, and occasional ones in Wolfe and Clay counties. Among these are noted, in Breathitt county, a bed close above Coal 5, quite plentiful about the heads of the small streams above Troublesome creek, but too sandy to be of value, and a bed twenty to forty feet above Coal 1, which on Frozen creek appears good; but, extending into Wolfe county as far as Campton, is also sandy in its greater part.

The lower limestone ore of the Red river is found as far up as its place lies above the river bed, but it probably diminishes in quantity eastward to that point, and southward also, as none of it was seen south of the Red river.

A most unusual occurrence of ore is found at John Clemens' at the head of South Quicksand creek, Breathitt county, where it lies in a vertical fissure vein about eighty feet above a coal opening, probably Coal 4, and about one hundred feet below a bench said to carry a fine quality of calcareous iron ore. The vein would appear to be near the level of the ore bed next above Coal 5.

An opening in the sharp point of a hill follows the vein down to a depth of about ten feet, between walls two to three feet apart, of sandstone lying horizontally. The vein filling is of earth, through which runs, parallel to the walls, a continuous seam of pure hematite, two to eight inches thick, small scattering pieces of ore, also lying vertically, being adjacent to the main seam. At the bottom of the pit the vein is said to make a sharp turn, and continue horizontally on the top of a thin bed of coal. The exploration was abandoned after following about five feet in this direction, and the place is now partly refilled with earth.

The vein was excavated from the surface a length of eight feet, beyond which no search for it was made. Its direction is about east and west. The opinion first formed by the

writer, that the fissure was made by the breaking of the cliff of a former "rock-house," is brought to question by the credible report by Mr. Clemens of other singular formations in the vicinity.

Limestone.

The sub-carboniferous limestone, exposed in cliffs of Red river and its branches in Wolfe county, and again in those of Pine mountain, in Harlan county, is the only constant limestone in the region, and it is below drainage almost altogether.

The ferriferous limestone of the "Hanging Rock" iron district crops out at frequent intervals on the north side of the North Fork, in Breathitt county, never more than five feet thick, and usually impure. An attempt to make lime from that of A. C. Cope's, on Frozen creek, is said to have resulted successfully, but most of the rock is unfit for it.

The calcareous concretions of the lower shales are abundant in Wolfe county, over Coal 1, in layers three or four inches thick, and serve for a mark in tracing the lower beds. Less numerous layers are found, however, in the shales above Coals 2 and 3—in the latter as far south as Grapevine creek, Perry county.

Large calcareous bowlders have been noted only in Breathitt county, north of the mouth of Troublesome creek, where they lie immediately above Coal 3.

The hard, black, fossiliferous limestone of section 73, of which no counterpart has been discovered elsewhere in the region, lies, about five feet thick, at the head of Peach Orchard branch, the next stream below Hell-for-Certain creek, Leslie county.

In Clay county a thin limestone at J. T. Smith's, Tom's branch, Red Bird creek, is the only one which has come to the notice of the writer.

Conglomerate.

The outcrop of the conglomerate is roughly indicated in the opening pages of this report; some further comment upon it is desirable.

In Wolfe county the formation may be said to include two benches of sandstone, containing quartz pebbles in greater or less profusion, with an intervening stratum of shales, the whole approximately 200 feet thick on the Red river, and undetermined on the waters of the North Fork, Kentucky river.

Between the conglomerate, as defined above, and the sub-carboniferous limestone, is a stratum of shale 100 feet thick, at the mouth of Swift's Camp creek, and but fifty feet near the mouth of Chimney-top creek. The thickness of this shale is easily determined on Red river, but becomes uncertain in the south-western part of the county.

On the Red river the upper bench of sandstone carries a profusion of pebbles, while the lower bench has but few. On the North Fork waters neither bench has many, the number constantly decreasing toward the south; so that in Breathitt county they become a rarity, and where the upper part alone of the formation is exposed, careful examination is required to distinguish it.

Especial difficulty is met because of its very irregular surface—much more uneven than that of the coal stratum immediately above it.

An example of this irregularity is evident near Campton. Swift's Camp creek there runs on the top of the conglomerate, and also a branch of the creek on its top two miles westward on the Winchester road. The branch is about 100 feet above the main stream, and the consequent slope of the conglomerate has no counterpart in the strata above, as may be seen from the smooth and nearly level benches along the hills between the two points. No evidence of non-conformation has been found, however, which can not be accounted for on the supposition that the first coal strata were deposited on a very uneven bed, which sometimes even protruded above the level of the coal-forming swamps.

The flat creek bottoms, generally found just above the points where the streams begin to cut through the hard top of the conglomerate, are often a guide to its location where the rock itself can not be seen, though the bottoms usually rise almost imperceptibly onto higher strata. Once the cut is begun, an

exposure of a five-foot layer of cross-laminated sandstone, five to fifteen feet from the top, is often found; and this is the principal means of identification of the rock in Breathitt county, though occasional pebbles still may be found in it.

By this cross-cleavage the rock is recognized as reappearing on Holly creek, below Mrs. Hollin's, where it is cut into by the stream ten to fifteen feet, though farther down, near the mouth of Hunting Fork, it is below the stream bed.

A like elevation has taken place on Stillwater Fork, Frozen creek, and it is believed that the cliffs reaching a height of about fifty feet on main Frozen creek, between Cope's Fork and Davis branch, are of the conglomerate formation, though it must be admitted that the principal evidence found is in their gorge-like character. The lower coal, and other beds lying at an easy slope on either side of this mass of rock, are supposed to have their edges abutting against it, while higher ones lie smoothly over it. On Cope's Fork no such cliffs appear.

Between the North and Middle Forks irregularities of this nature have not been found, stream beds rising rapidly to the top of the conglomerate, and then continuing on and above the top to their beginning.

In Clay county no inherent peculiarity has been discovered in this formation by which its rocks may be distinguished from others, excepting its tendency toward the formation of cliffs where it is particularly durable. These cliffs have been mentioned already.

Their frequent sudden terminations and apparent replacement by sandy shales (taking also into consideration the shaly character of the formation towards the mouth of the South Fork) are indicative of a large area of conglomerate shale outcrop replacing the upper sandstone in the western part of the county.

Probably the strongest evidence in this direction is to be found near J. L. Hornsby's, on Laurel creek. There the sandstone cliff rises about forty feet from the creek and is capped by a bed of coal which can only be regarded as Coal 1—the same bed that is found along Goose creek. A mile above Hornsby's what appears to be the same bed is 100

feet above the creek, a uniform shale reaching from the creek to the coal.

This shale, indeed, is so sandy that it might nearly as well be called a very fine-grained sandstone. Where exposed to the weather it disintegrates like ordinary shale, but the fresh rock has little appearance of it, and has even a slight ring, as of limestone. It gives a good light soil to the bottom lands of much of this part of the county.

Another view of the formation worth considering is, that the cliff-forming sandstone is the top of the conglomerate and the shale a subsequent deposit. This induces belief that the upper surface of the conglomerate is extremely uneven, and that, previous to the growth of any material forming coal, the depressions of the rock were filled with shale, such as has no place in the series north of the Middle Fork. Further study of this question in the field is necessary for its solution.

Sandstone.

The sandstone of the region has the usual characteristics of the formation, the numerous stone chimneys constructed showing that an abundant supply for local use, of easily worked and good building stone, may be had in any part of it.

Notably between the North and Middle Forks, in Perry county, and between the Middle and South Forks, from Long's creek, Breathitt county, to Rockhouse creek, Leslie county, the sandstone above Coal 8 (Mahoning sandstone) assumes a prominence which, it is believed, will be a material aid in a **more thorough** investigation of the measures there. At various points on these ridges its great resistance to weathering has given a comparatively broad and flat top to the hills, in marked contrast to their usual narrow summits. Most prominent among them is that at the head of Squabble creek, Perry county, where the gap to Buffalo creek is on the top of the rock, the distance on it from stream to stream being upwards of a mile.

Salt.

Attempts have been made to obtain salt by boring wells at various points on the North and Middle Forks, but the

abandonment of them all shows a lack of financial success. This is probably chiefly due to conditions independent of the supply obtained, among others the small market accessible, but for a few of them it must be attributed to weak and insufficient brine. Possibly deeper borings would have resulted better, as was found to be the case in Clay county. The more important of these wells are described in Dr. D. D. Owen's reports on the Survey for the years 1854 and 1855.

In the same report, pages 67 and 218, are described the salt wells of Clay county, which at that time were producing a considerable amount of salt. Only two of the wells are now in operation, competition with other supplies having cut off a large part of the former market. These two are situated at the forks of Goose creek, where the most abundant supply was found, and their combined production is said to be about 2,000 bushels of salt per year, one-tenth of the yield from about twelve wells in operation in the county thirty years ago. No sensible diminution in quantity or strength of brine is believed to have taken place in that time, the strength being said to remain constant at about ten degrees, while a slight reduction of quantity is attributed to leaks in pipes, which are not kept in good repair.

Gas.

The active interest in natural gas now awakened by its successful application to manufactures makes it worth while to repeat the description of the "Burning Spring" given in Dr. Owen's report, referred to above, page 217, which is as follows:

"The 'Burning Spring,' of Clay county, is one of the remarkable geological phenomena of this section of the country. Through a pool of water in a narrow bottom a constant stream of gas escapes in copious volumes. A lighted match suffices to set the gas on fire, which flashes instantaneously into numerous jets across the pool, continuing to burn until the force of the gas, or a gust of wind, blows it out. Judging from the color of the flame and the odor of the gas, it appears to be a mixture of heavy and light carburetted hydrogen, with some free or uncombined hydrogen.

"The commotion in the water rendered it too turbid, without filtration, to test it satisfactorily for its saline constituents. Bi-carbonate of iron seems to be the principal constituent.

"The gases must here reach the surface from some deep-seated source, through an extensive fissure of the rocks, concealed by the debris from the hills—perhaps from some bed of coal or iron ore exposed to surheated (superheated) steam or other heat, by which decomposition is effected with evolution of these gases. Whatever their origin may be, the materials which supply the elements must be contained in the interior of the earth on a vast scale, since the 'Burning Spring' has continued to evolve these gases with unremitting energy since the country was known to the first settlers. In half an hour during which I continued to watch its action, I could not perceive any cessation or intermission."

It is said that two of these springs are found on branches of Sexton's creek, one of which, on Sacker branch, was visited by the writer, and a cursory examination made. The above description is there applicable, no apparent change having taken place in the character or amount of gas escaping, after the lapse of thirty-odd years since the first recorded visit was made. The conglomerate rock crops out in the valley a short distance below the spring.

That no effective utilization of this wasted heat has been attempted is rather surprising. If not applicable for other purposes, it might easily be carried to the salt wells at the forks of Goose creek, about ten miles, and be economically used there in the evaporation of brine.

Silver Ore.

Considerable time and means having been spent in desultory and unavailing search for silver ore in various localities of this region, as well as elsewhere in this coal field, it is desirable to state that as yet no indication of any deposit of silver ore worth exploitation has ever been discovered in the Appalachian coal fields; and also that no true vein of any kind has been found in the eastern field of the State, excepting the one here described under the caption of iron ore. From these facts, after such investigation in this field as has

been made, it may be assumed as reasonably certain that no paying quantity of silver ever will be found in it, though it is beyond dispute that occasional silver-bearing ore has been found in exceedingly small quantities. The rugged conglomerate cliffs, which have attracted the most search, are not more likely to contain silver than other smoother surfaces.

The legends of Swift and his concealed silver mines and treasures, current in the mountains from Pennsylvania to Georgia and North Carolina, may be left to those who wish to believe them. It should be known, however, that the North American Indians had no knowledge of mining or metallurgy.

This report would be incomplete without acknowledgment of the faithful service, in the difficult work of exploration between the North and South Forks, Kentucky river, of Mr. James I. Profitt, through whose untiring zeal in searching for and opening coal outcrops such success as has been obtained in gathering information of the various coal beds is in a great measure due.

Apart from the subject in hand, but meriting record here for want of a place more suitable, the following description is added of a "pounding mill" in use on Lick branch, Red river, Clay county. This grist mill is probably the last of its kind in the State, the hand-mills and home-made four-bladed turbines cut from solid wooden blocks, and now in common use, having generally superseded them.

The mill consists essentially of a mortar and pestle; the mortar a short section of a tree, in one end of which a hole is scooped out for the reception of grain; the pestle a straight stick about four feet long, attached to one end of a lever supported in the middle.

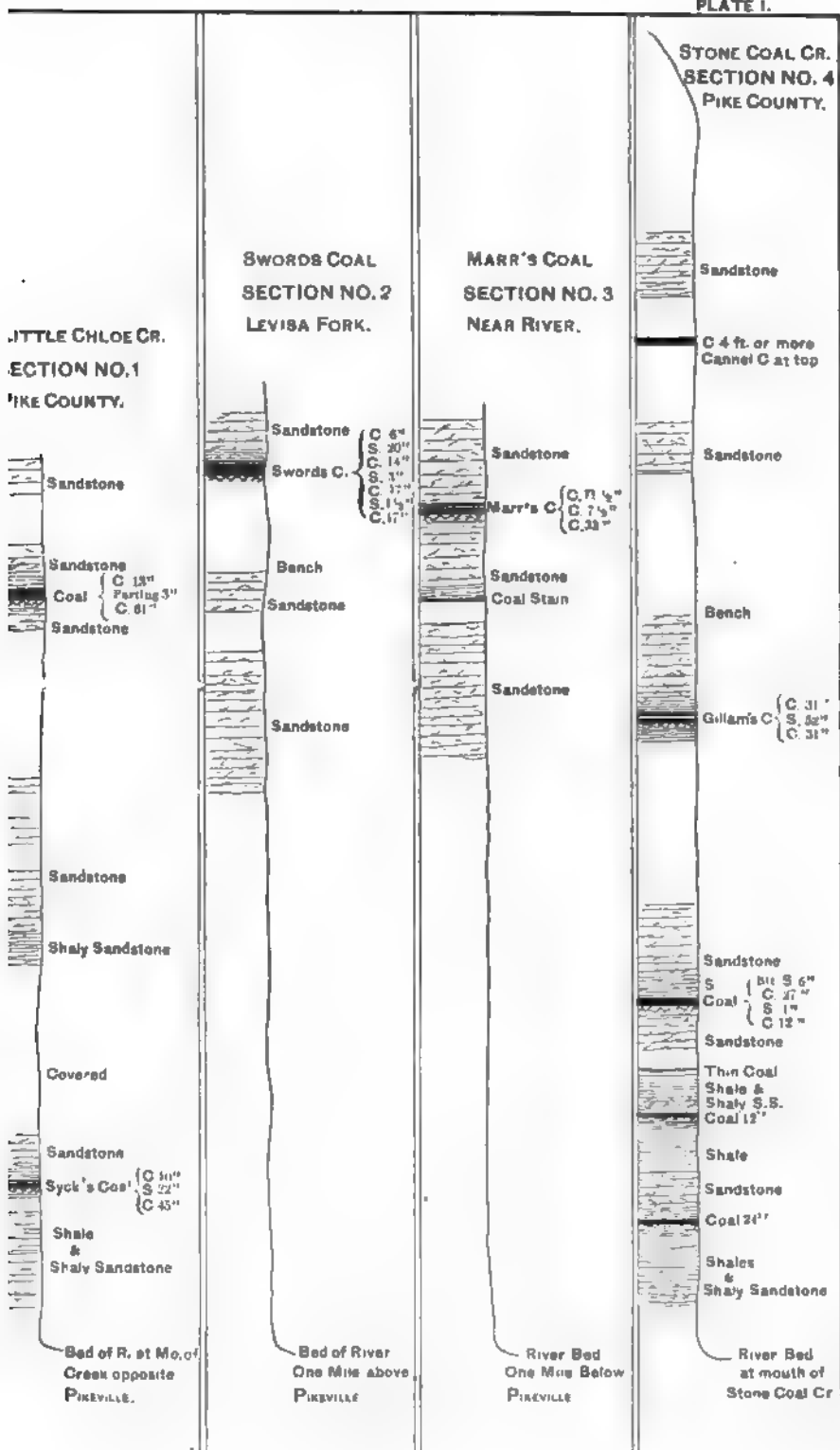
A weight is hung with the pestle in order to balance the opposite end of the lever, which end has cut in it a hollow place with a capacity of about half a barrel.

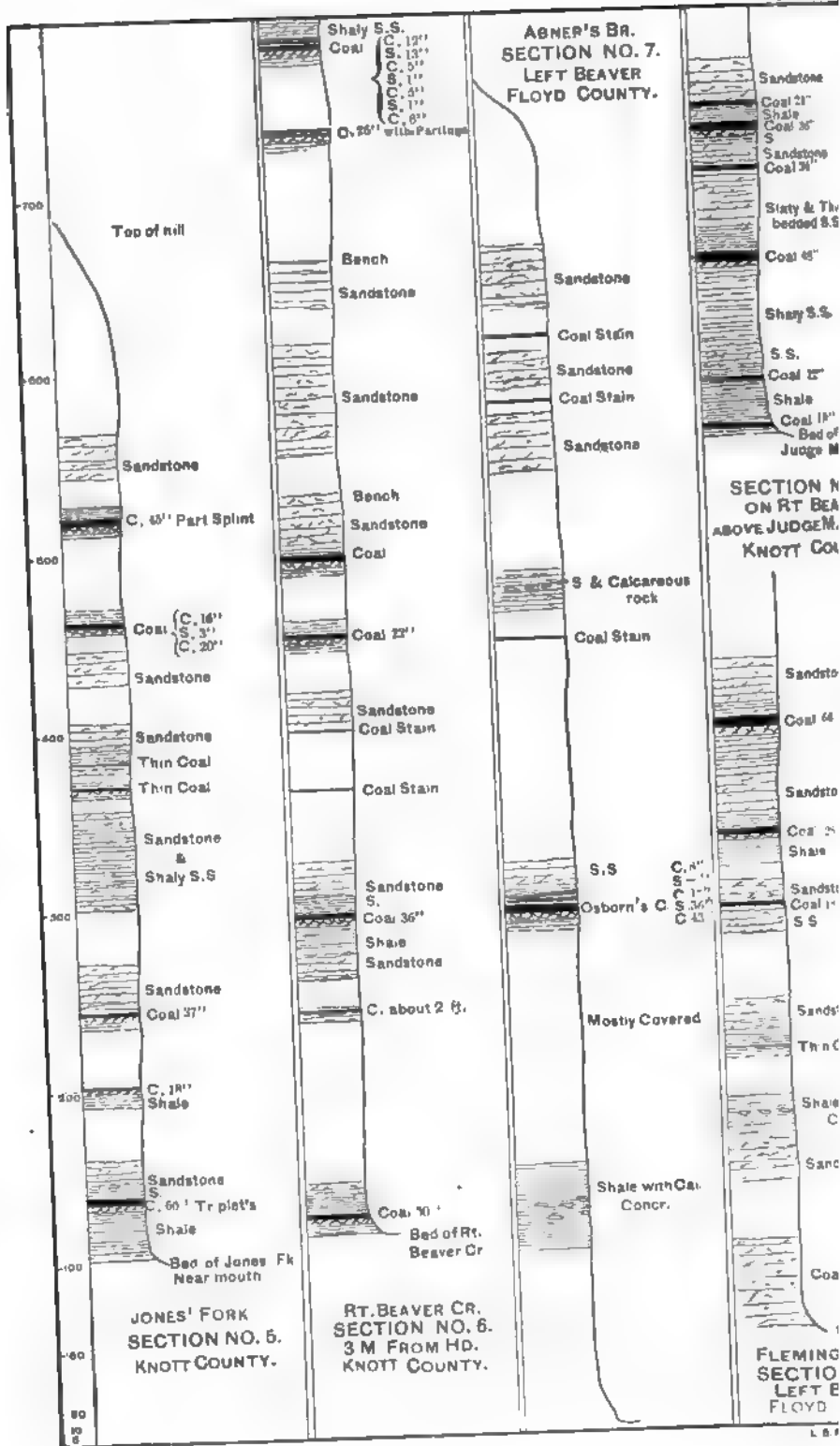
Water is led to this trough from the rapidly-falling stream by a conduit some 100 feet long, made of the bark of trees five or six inches in diameter.

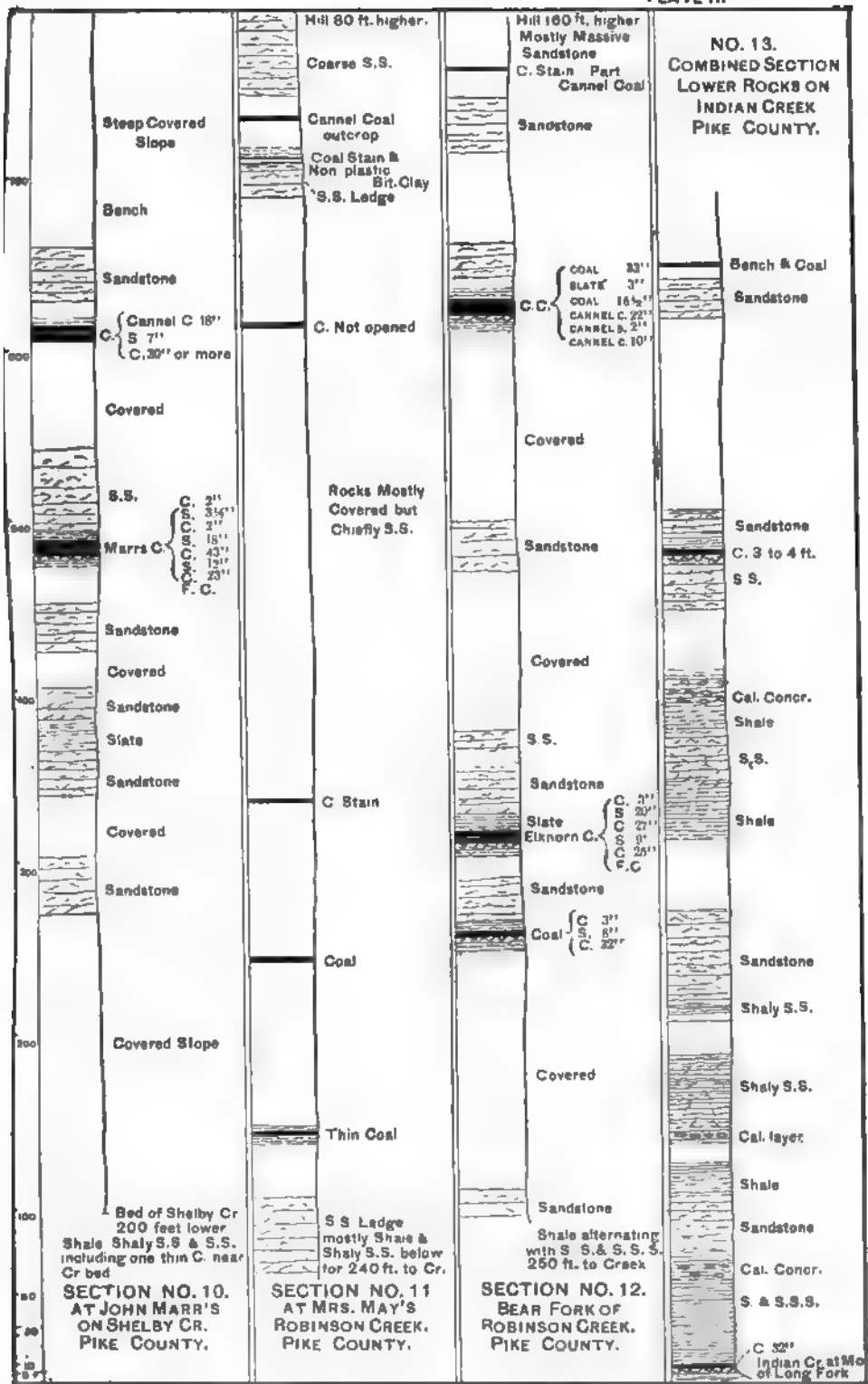
When the trough is filled with water the added weight causes it to descend, until its inclination is sufficient for

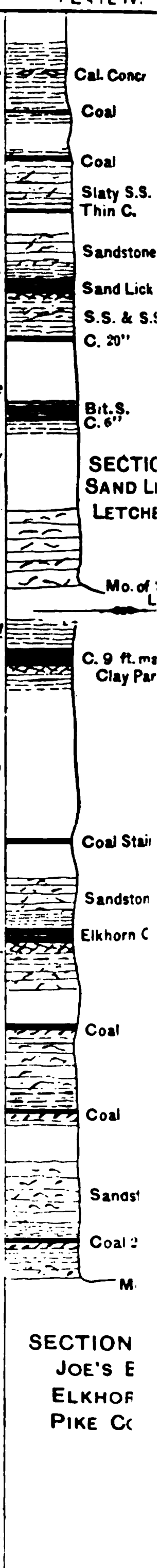
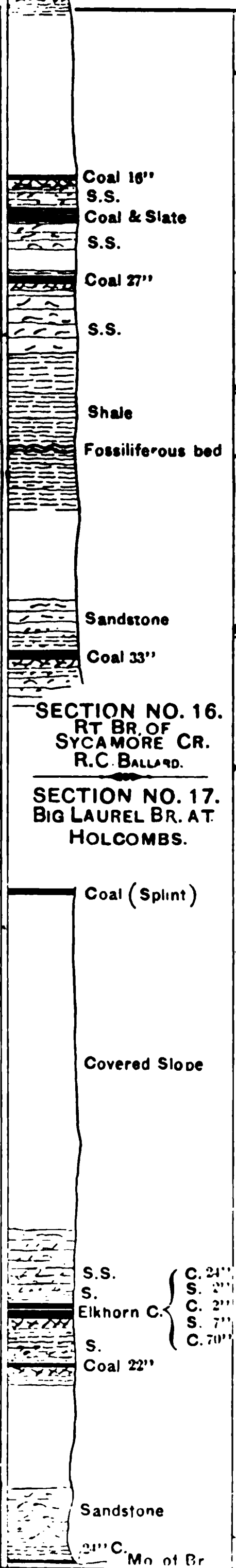
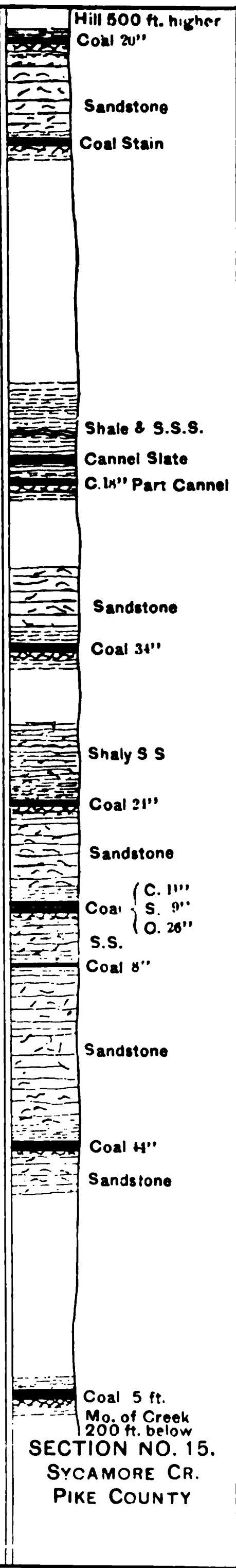
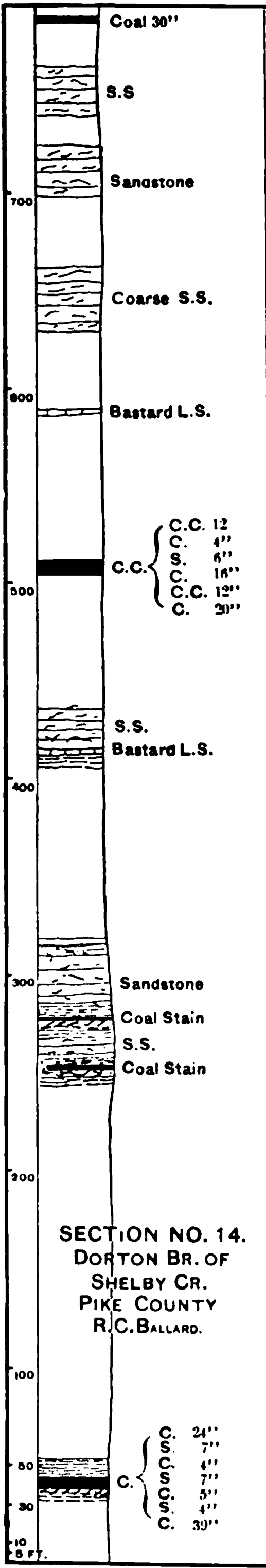
most of the water to run out. The greatest weight being then on the other end the pestle falls, and lifts the trough into position to be refilled.

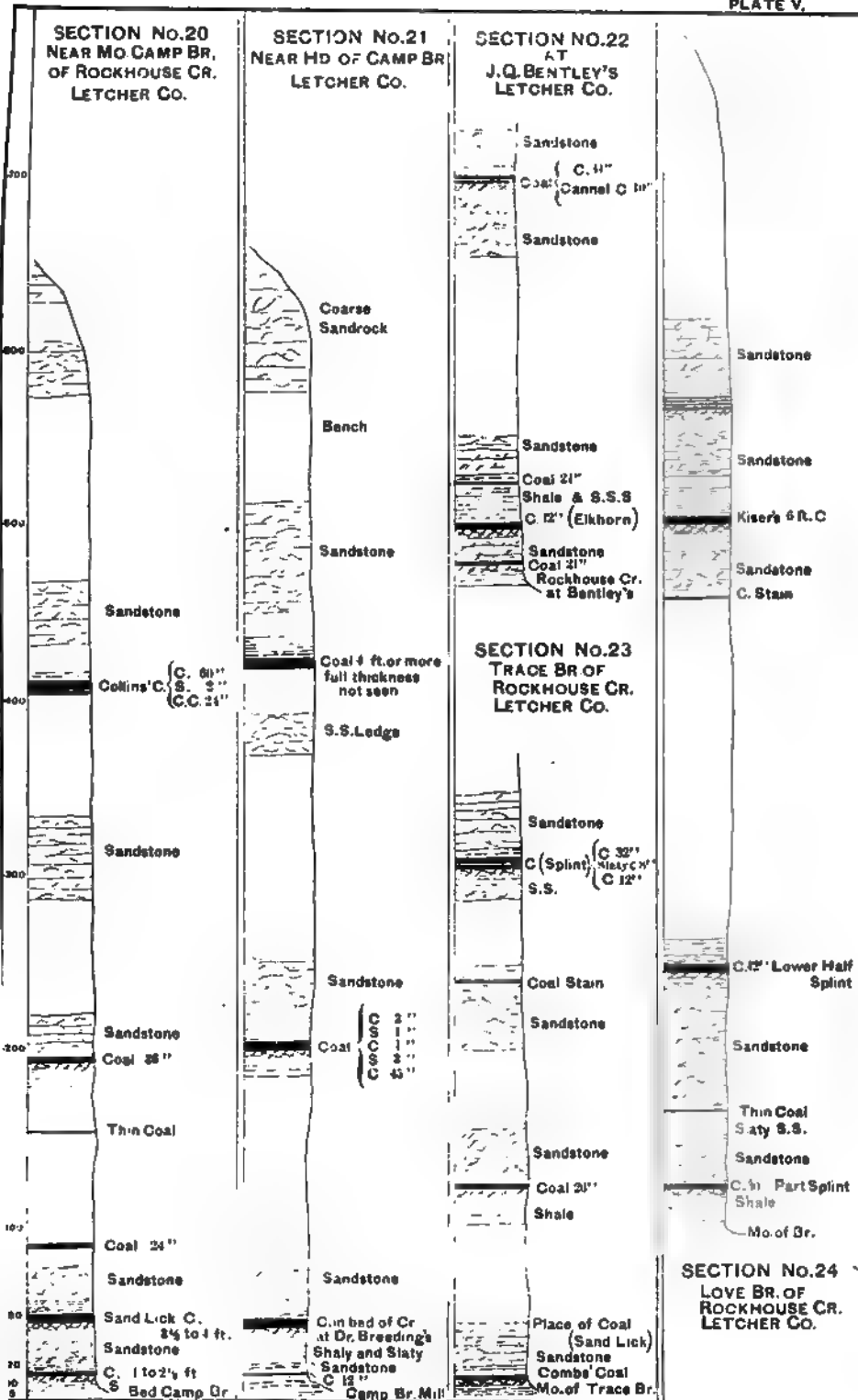
This see-saw motion continued, it is said, will crush into very nice meal a half bushel of corn left over night in the mortar; and also any stray field-mice, or other hungry, small animals which may venture into the mortar, left open and unprotected in the forest.

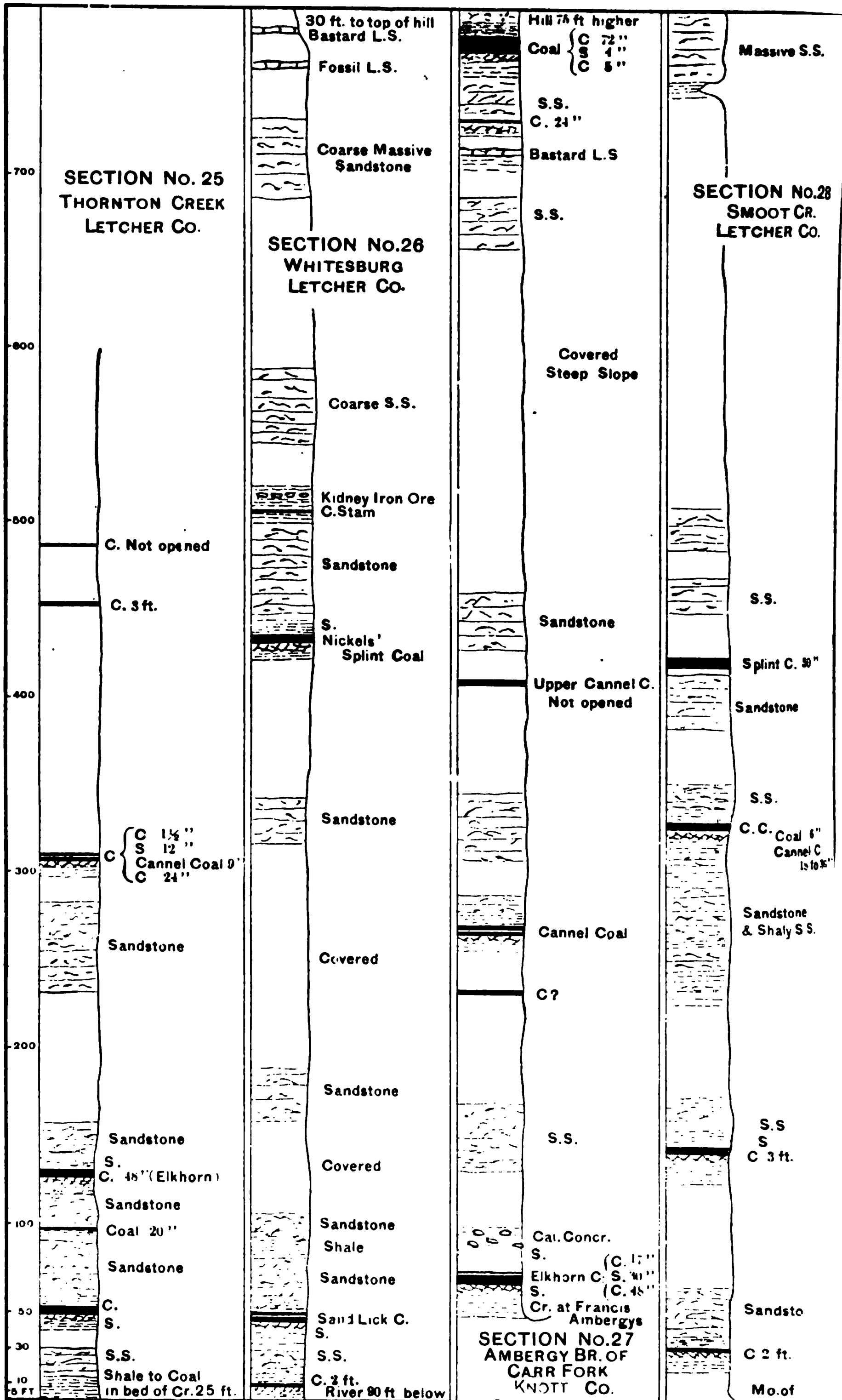


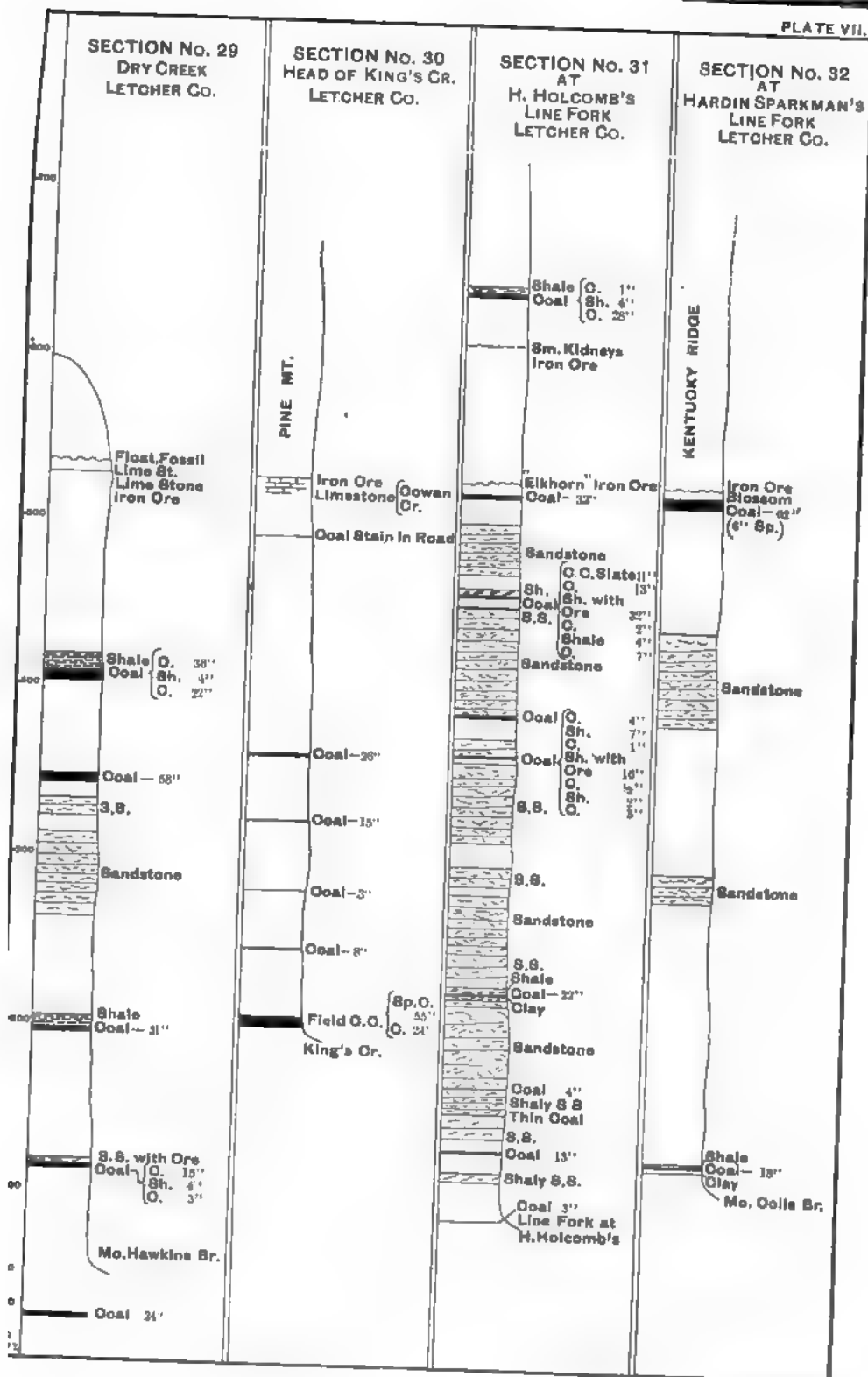


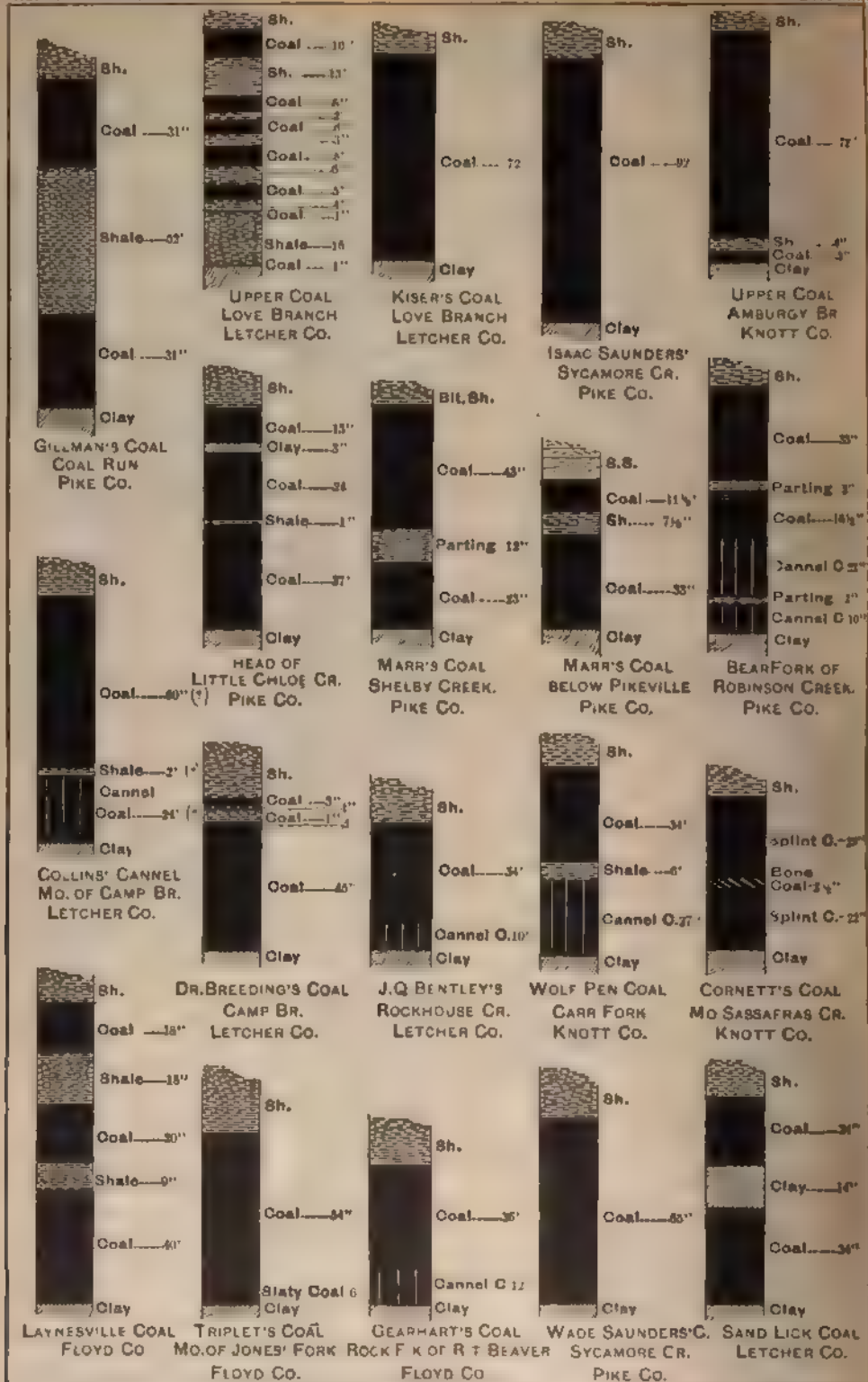








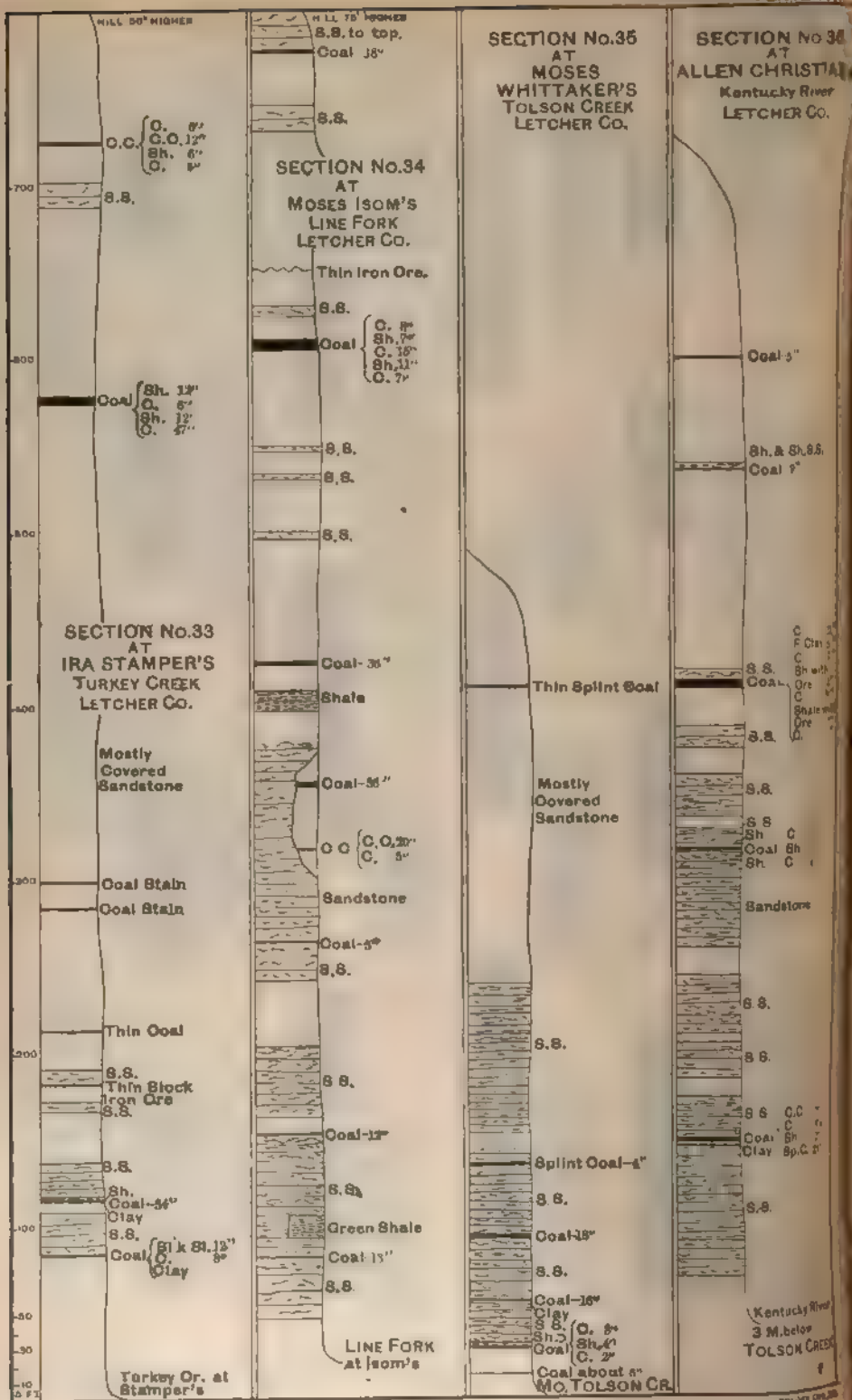


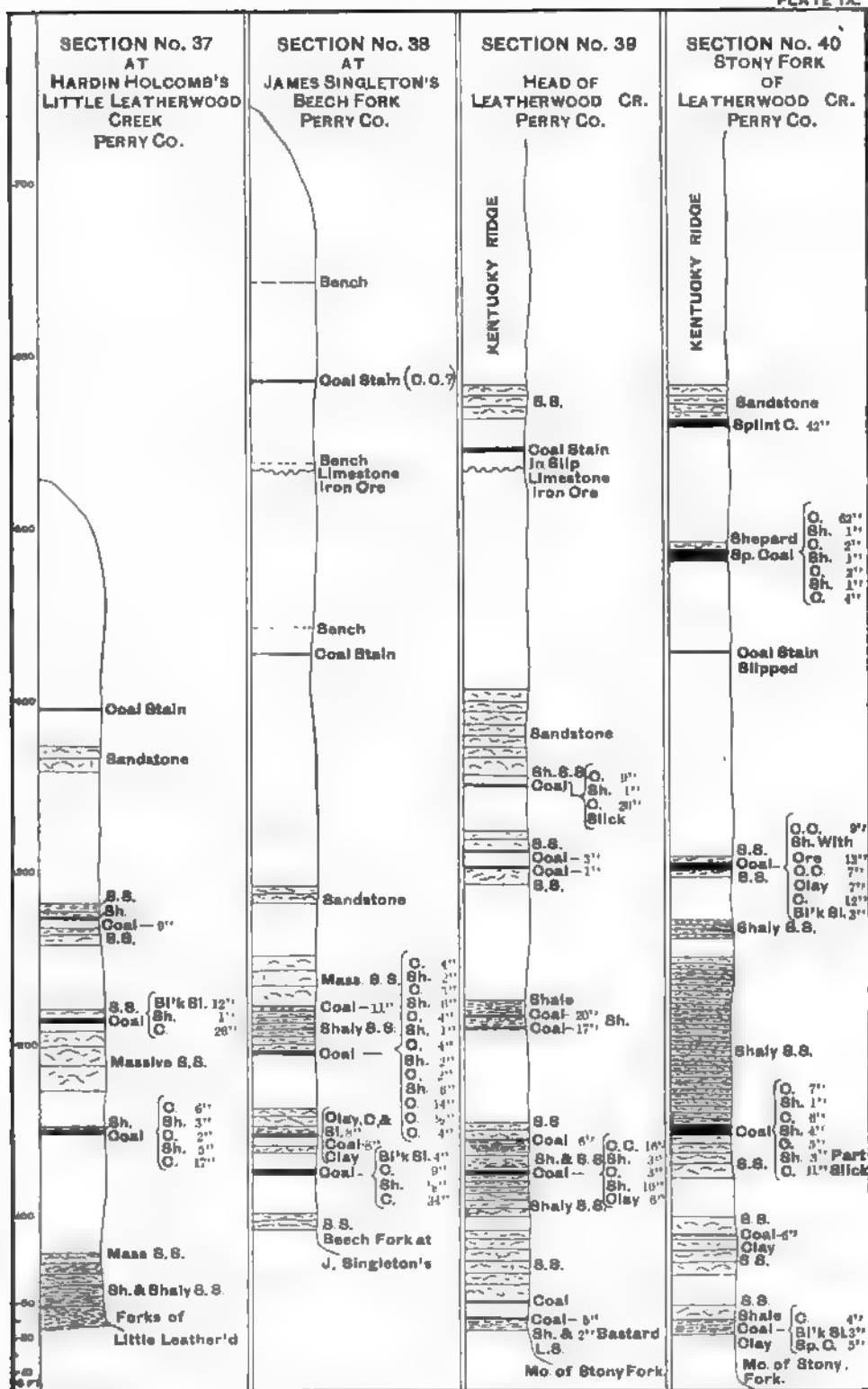


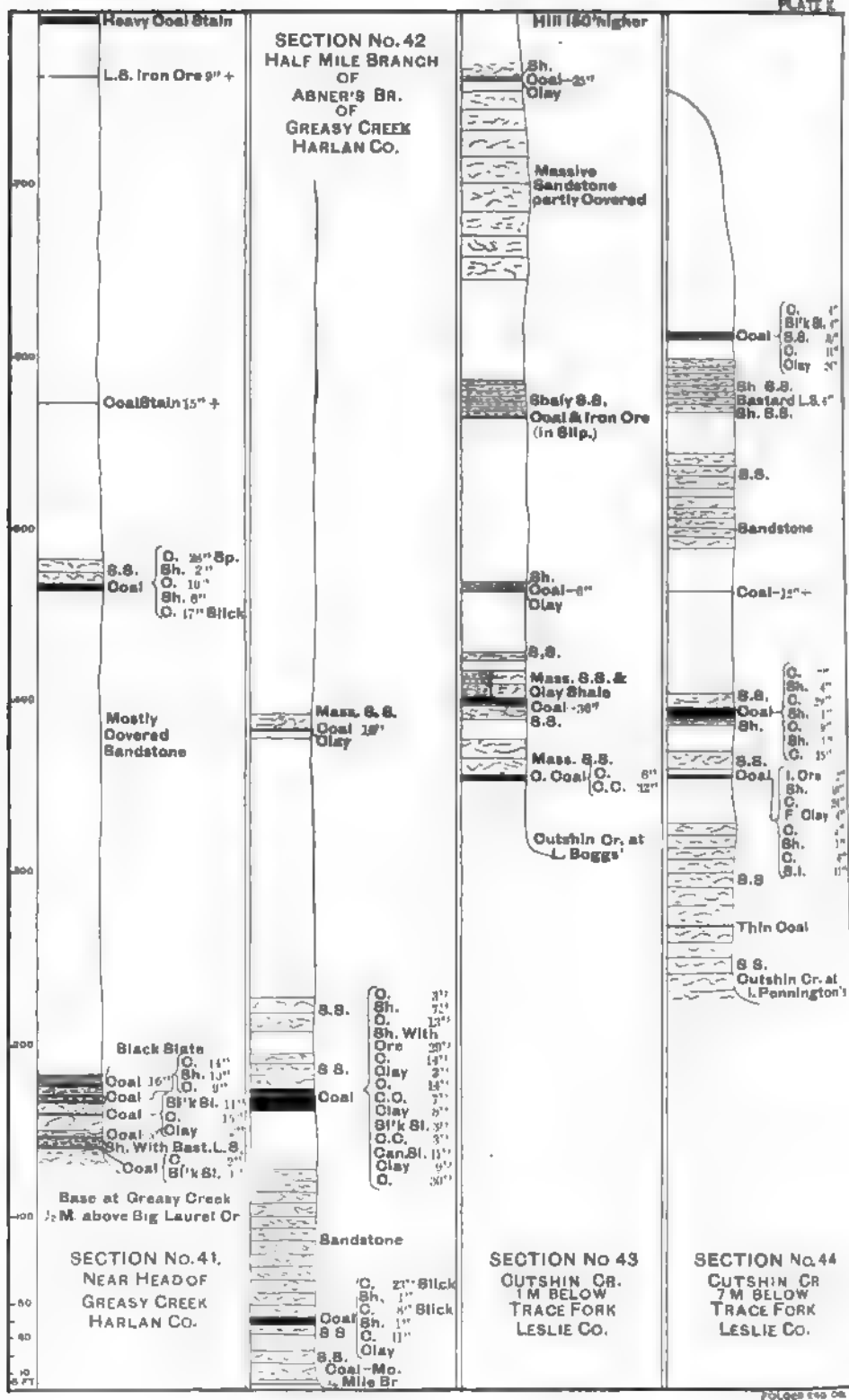
SECTIONS OF ELKHORN COAL

SCALE 5 FT. TO 1 INCH









SECTION No. 45
AT
WM. MCINTYRE'S
KENTUCKY RIVER
PERRY CO.

SECTION No. 46
AT
E. CORNETT'S
KENTUCKY RIVER
PERRY CO.

SECTION No. 47
COMBINED FOR
LOT'S CREEK
PERRY CO.

SECTION No. 48
TUNNEL MILL
TROUBLESOME CR.
PERRY CO.

700
600
500
400
300
200
100
50
30
10
5 FT.

Slate
Coal 5"
Clay

Sh.
Coal 5"
Clay

Sandstone

Coal { O. 2' 2"
F. Clay 2'
Bl'k Sl. 9'
O. Clay 1'

S.S.
Coal { Sp. O. 12"
S. 5"
Sp. O. 3"
Bl'k Sl. 3"
Clay 1'

Thin Coal

S.S.

Coal - 24' at
Bed of River
3 M. below Leathw'd

S.S.

Coal - 2'

Sandstone

Sp. Coal - 12'

S.S.
Sp. Coal { O. 44"
Sh. 1"
O. 11"

S.S.

Bl'k Sl. { O. 18' with
Partings
S. 4"
O. 15"
S. 8"
O. 3"

Kentucky River
3 M. above Hazard

Coal { O. 13'
Clay 12'
Sh. 12'
O. 12'
O. 8'

Coal 12' to { O. 22"
Sh. 3"
O. 22"

Shale

Coal 2'

Shale S.S.

Coal { O. 10"
Sh. 8"
O. 24' Sp.
Coal { O. 22' 17"
B. Sl. 0' 3"
O. O. 22' 22"

Sh. with Calc.
Conc.
Coal 8'

Mo. of Lot's Cr.

Sandstone

Coal { O. 39"
Sh. 3"
O. 4"

S.S.

Red Clay Shale

Coal - 10'

S.S.

Engle { O. 16"
Sp. Coal { Sh. 5"
O. 5"
Sh. 13"
O. 30"

Bastard L.S.

S.S. { O. 4"
Coal { Sh. 7"
Trace Br. { O. 4"
O. O. 13"

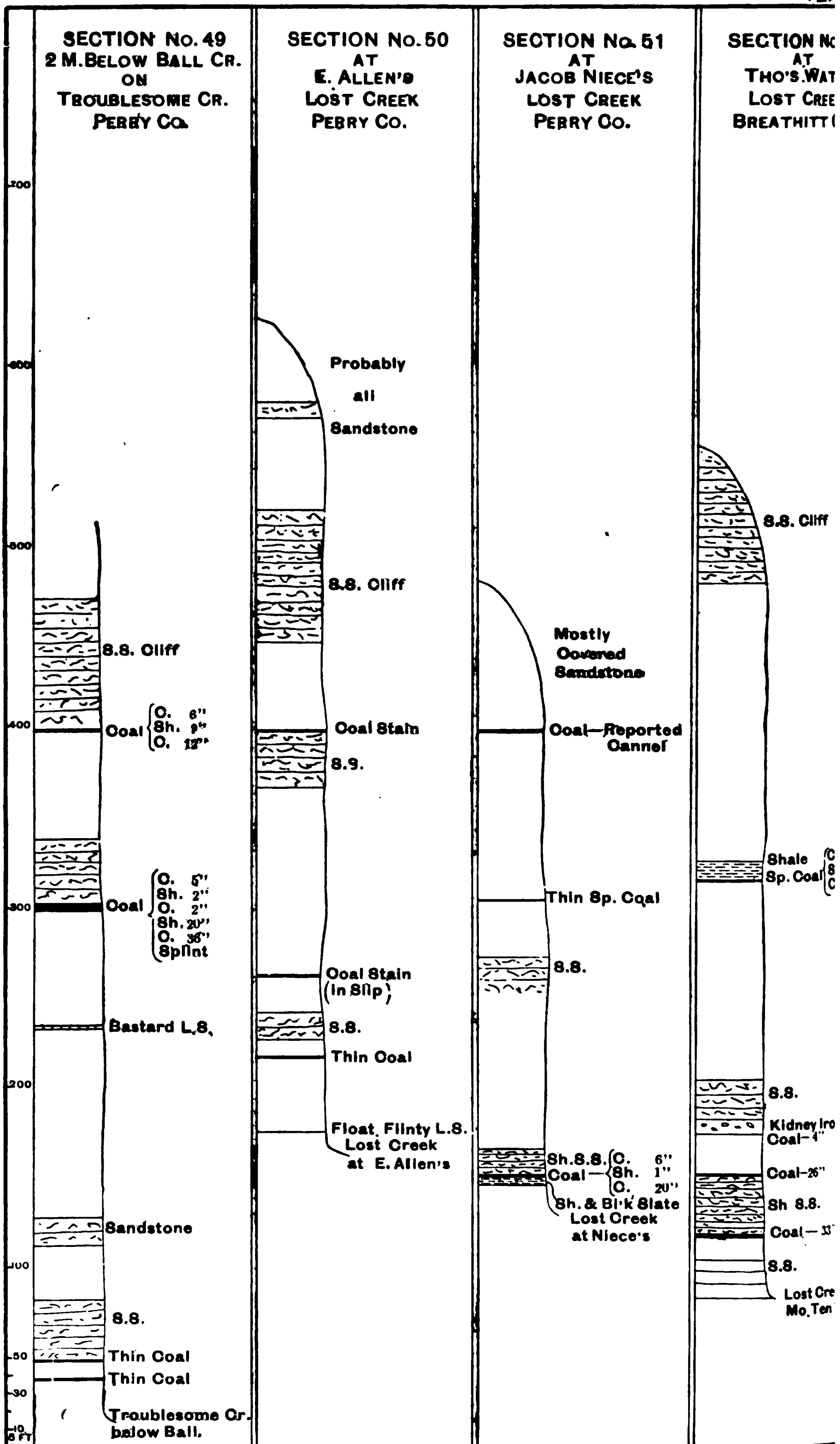
S.S. { O. 12"
Coal { Bl'k Sl. 10"

Black Shale

S.S.

Coal - 30'

Troublesome
Cr. at MLR

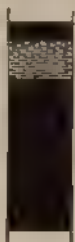


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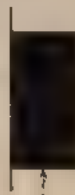
H HAWKINS'
DRY CREEK
LETCHER CO.



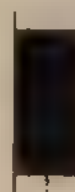
IRA STAMPER'S
TURKEY CREEK
LETCHER CO.



LEATHERWOOD CR.
PERRY CO.



J. RHOILEY'S
RUSSELL FORK
BREATHITT CO.



L.H. NOBLE'S
LEATHERWOOD BR.
BREATHITT CO.



H. SPARKMAN'S
LINE FORK
LETCHER CO.



A. CORNETT'S
LAUREL FORK
LESLIE CO.



GRIGSBY'S
LOT'S CREEK
PERRY CO.

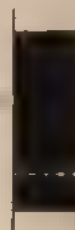


Splint C.

IRA HALL'S
DEFEATED CR.
LETCHER CO.



E. CORNETT'S
KENTUCKY RIVER
PERRY CO.



I. PENNINGTON'S
CUTSHIN CREEK
LESLIE CO.



NAPIER'S
HALF MILE BR.
HARLAN CO.



W. D. JONES & CO
KINGS CR.
LETCHER CO.



STONY FORK
LEATHERWOOD CR.
PERRY CO.



HALF MILE BR
GREASY CR.
HARLAN CO.

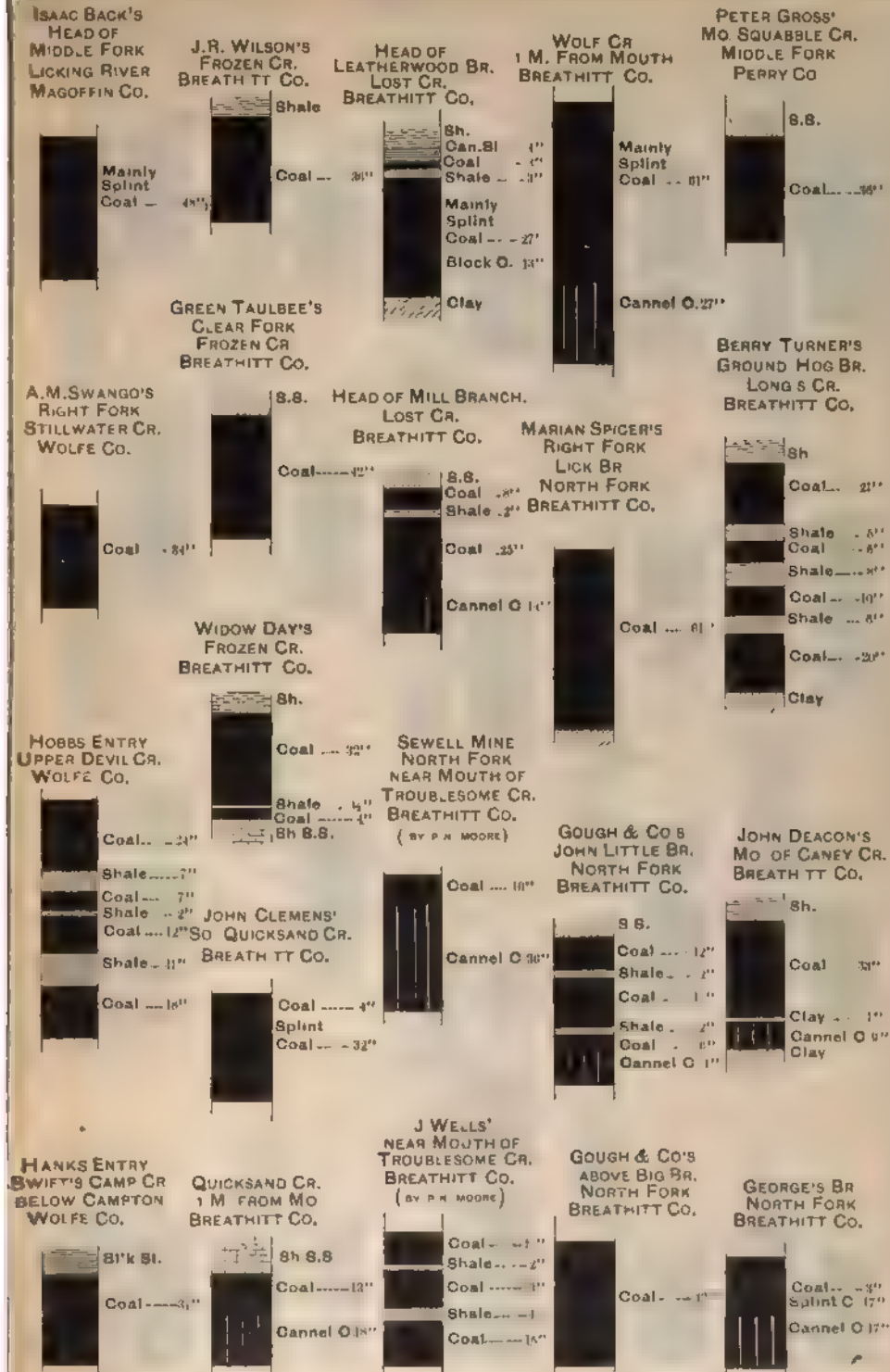


Splint C. 54

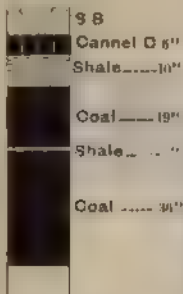
Coal 21



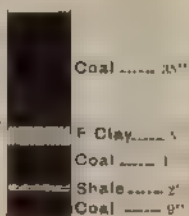
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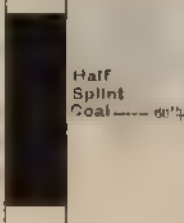
JOHN FIELDS'
FORKS OF BIG CR.
PERRY CO.



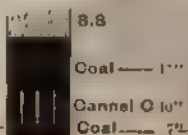
W. CAMPBELL'S
LEFT FORK
MACE'S CREEK
PERRY CO



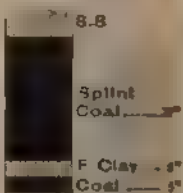
PIGEON ROOST BR
NORTH FORK
PERRY CO.



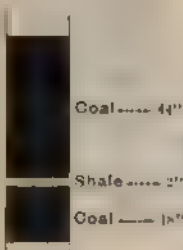
1 M BELOW
RUSH CREEK
MIDDLE FORK
PERRY CO



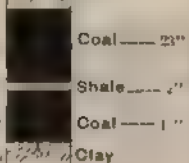
J.C BREWER'S
NEAR CUTSHIN CR.
LESLIE CO



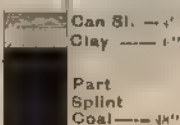
ALFRED EBERSOLE'S
JENNY LICK
LEFT FORK
BIG CREEK
PERRY CO.



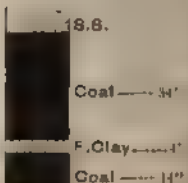
JOHN SPENCER'S
GRAPEVINE CR.
PERRY CO
S.S.



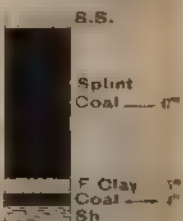
S.W. TAKER'S
WILLARD CR.
PERRY CO



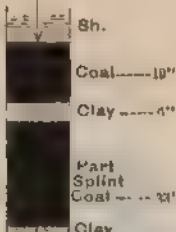
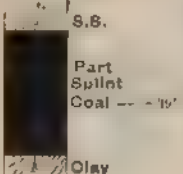
MO OF GUY'S CR
MIDDLE FORK
PERRY CO.



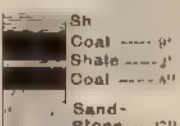
REUBEN MAGYARDS
CUTSHIN CR.
LESLIE CO.



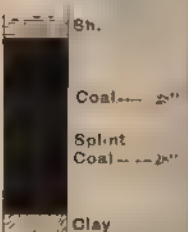
ALEX COMBS'
NORTH FORK
5 M BELOW HAZARD
PERRY CO.



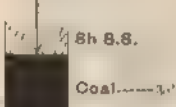
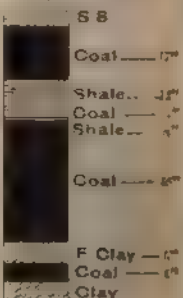
THO'S JOHNSON'S
NORTH FORK
PERRY CO



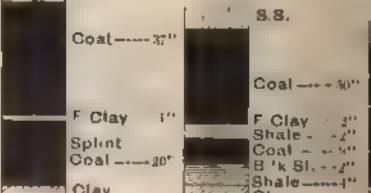
A. CAMPBELL'S
FISH TRAP BR
NORTH FORK
PERRY CO.



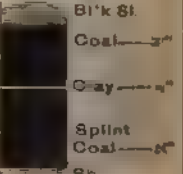
JOHN LEWIS
HURST BRANCH
MIDDLE FORK
LESLIE CO



J CAMPBELL'S
MOUTH OF
ROCK LICK BR
NORTH FORK
PERRY CO

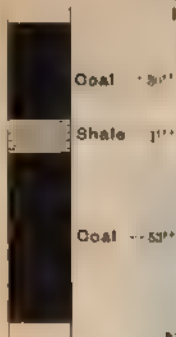


BOWLING'S ENTRY
RUSH CREEK
MIDDLE FORK
PERRY CO

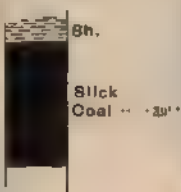


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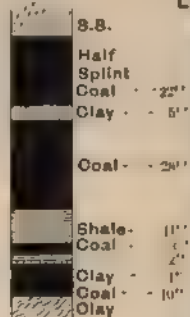
JOHN BAKER'S
FACE TRACE
WHITE OAK CR.
LESLIE CO.



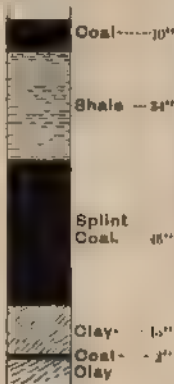
FORKS OF
LAUREL FORK
GREASY CR.
HARLAN CO.



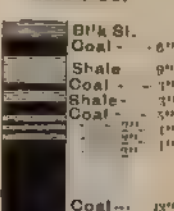
DALE BLEDSOE'S
REUBEN BR.
BEECH FORK
HARLAN CO.



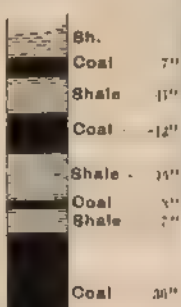
SILAS NANTZ'S
OLDHOUSE BR.
BEECH FORK
LESLIE CO.



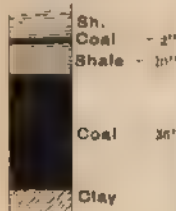
HUGHES MORGAN'S
MO. SALTWELL BR.
MIDDLE FORK
LESLIE CO.



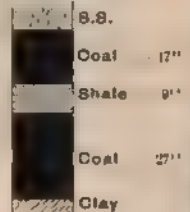
N. & MC C. SCHELL'S
UPPER DOUBLE BR.
LAUREL FORK
GREASY CR.
LESLIE CO.



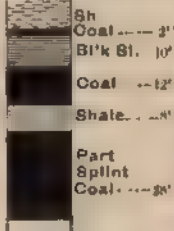
JOHN TURNER'S
WHITE OAK CR.
LESLIE CO.



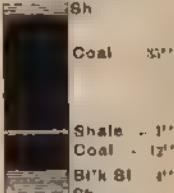
G.W. HOSKIN'S
BEECH FORK
LESLIE CO.



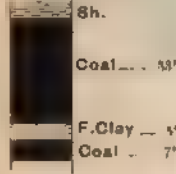
W'M HELTON'S
RAINBOW BR.
MIDDLE FORK
HARLAN CO.



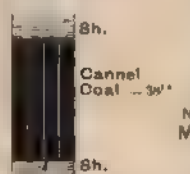
JESSE MORGAN'S
BURNT CAMP BR.
MIDDLE FORK
LESLIE CO.



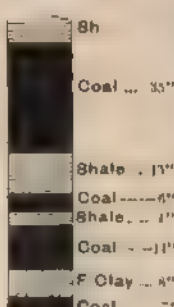
WHITE OAK CR.
NEAR MOUTH
LESLIE CO.



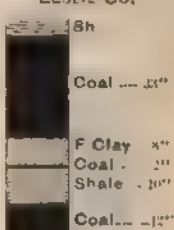
J. LEDINGTON'S
MO. OLDHOUSE BR.
BEECH FORK
LESLIE CO.



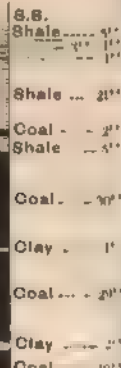
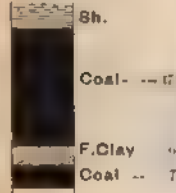
MIDDLE FORK
NEAR MOUTH OF
MARROWBONE BR.
LESLIE CO.

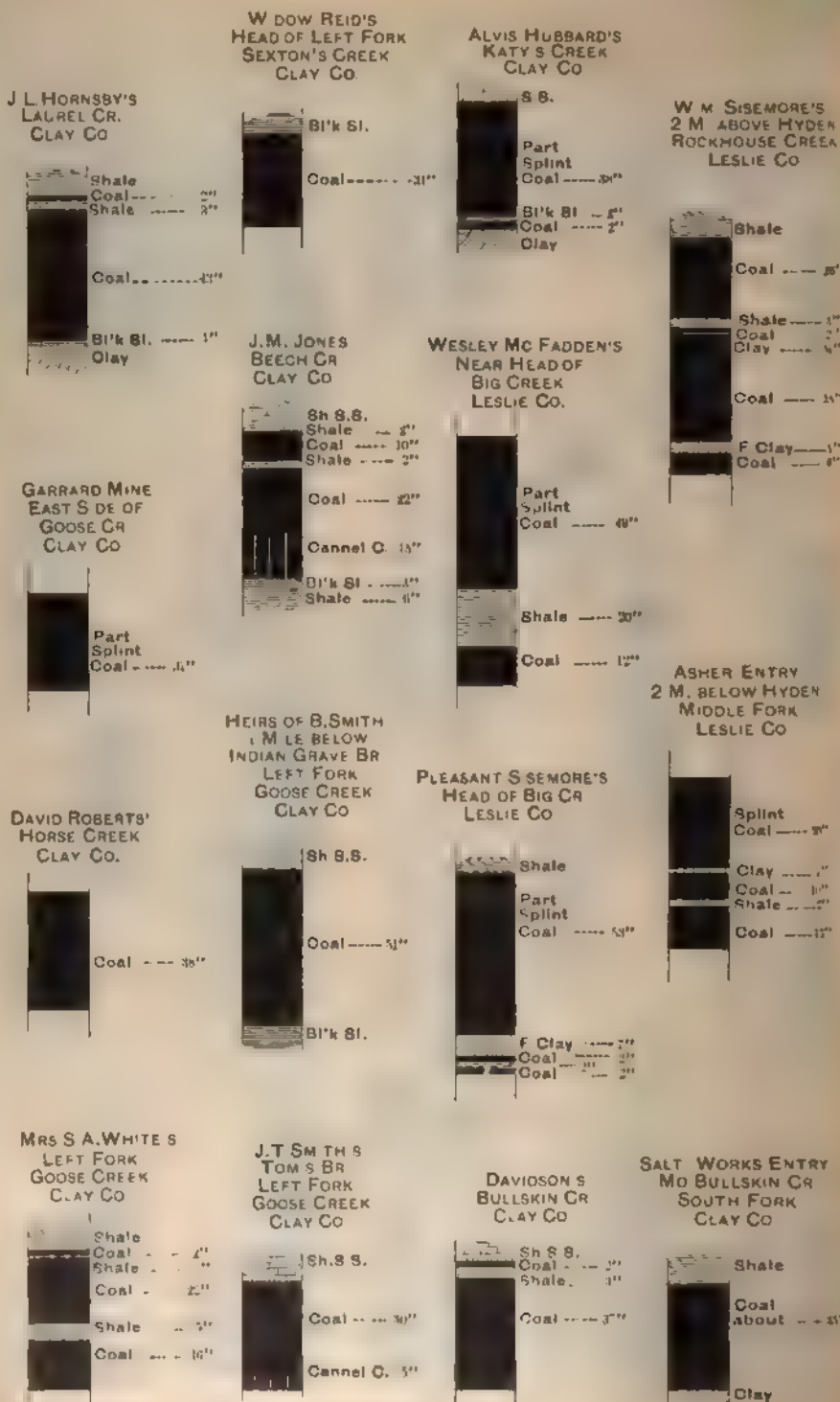


JOHN BOWLING'S
2 M ABOVE HYDEN
MIDDLE FORK
LESLIE CO.



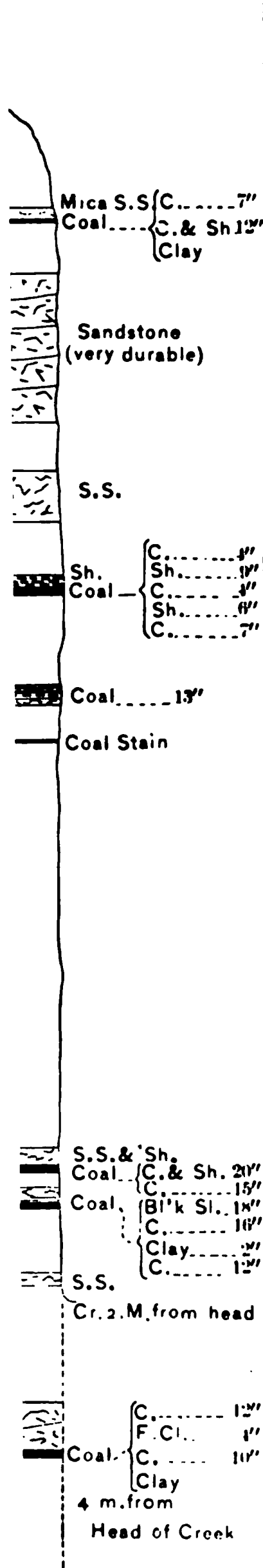
LEWIS BRANCH
GREASY CR.
LESLIE CO.





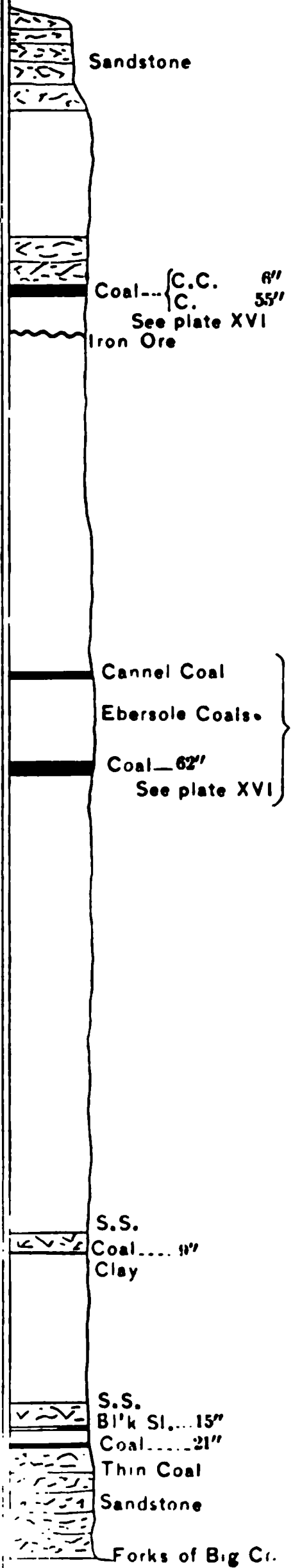
SECTION No. 57

AT
WILLIAM FARLEY'S
MACE'S CR.
PERRY CO.



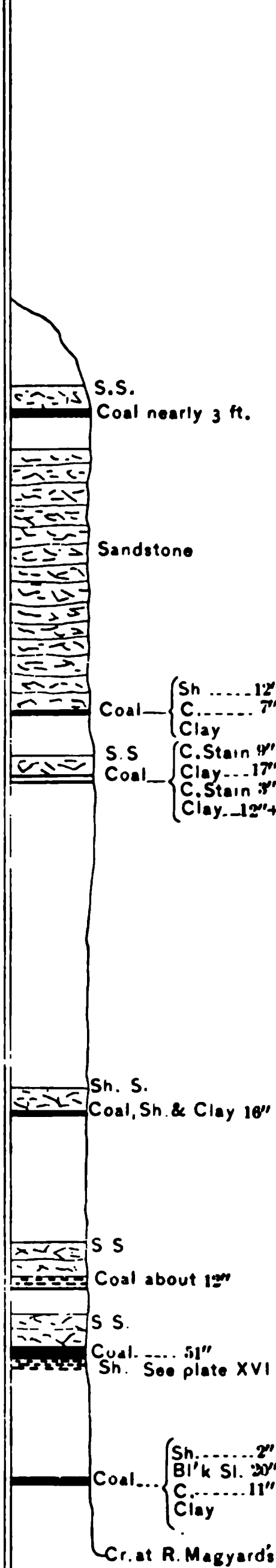
SECTION No. 58

AT
JOHN FIELD'S
FORKS OF BIG CR.
PERRY CO.



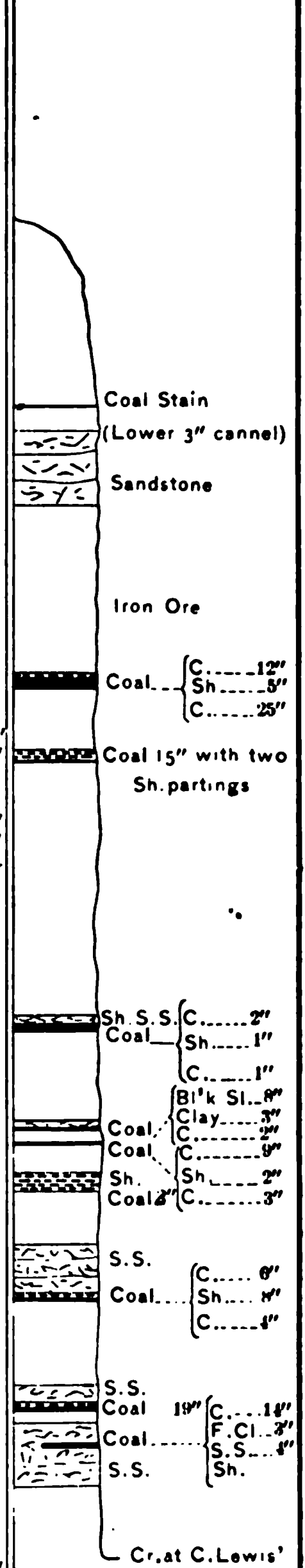
SECTION No. 59

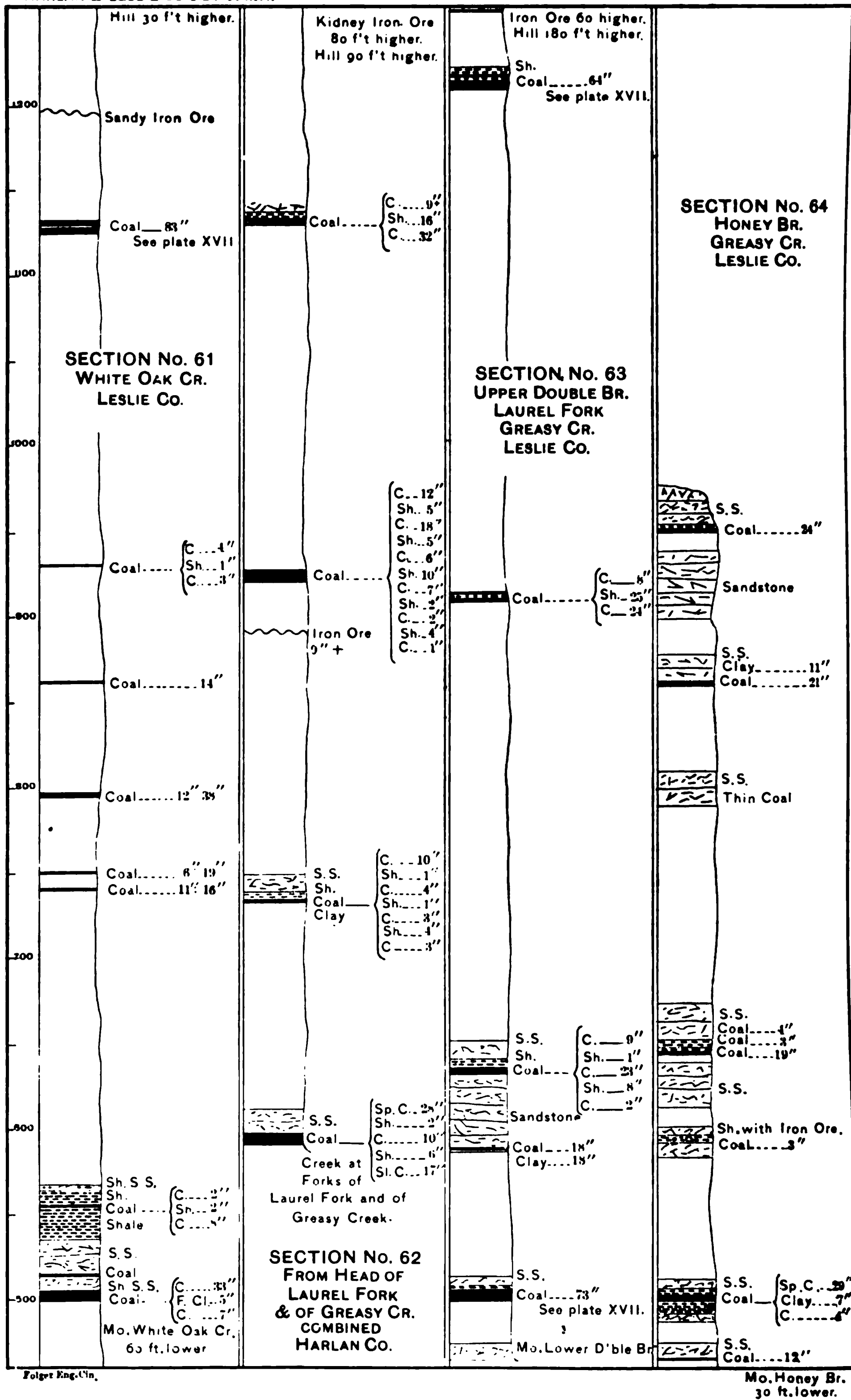
AT
REUBEN MAGYARD'S
CUTSHIN CR.
LESLIE CO.



SECTION No. 60

AT
CHRIS. LEWIS'
WOLF CR.
LESLIE CO.



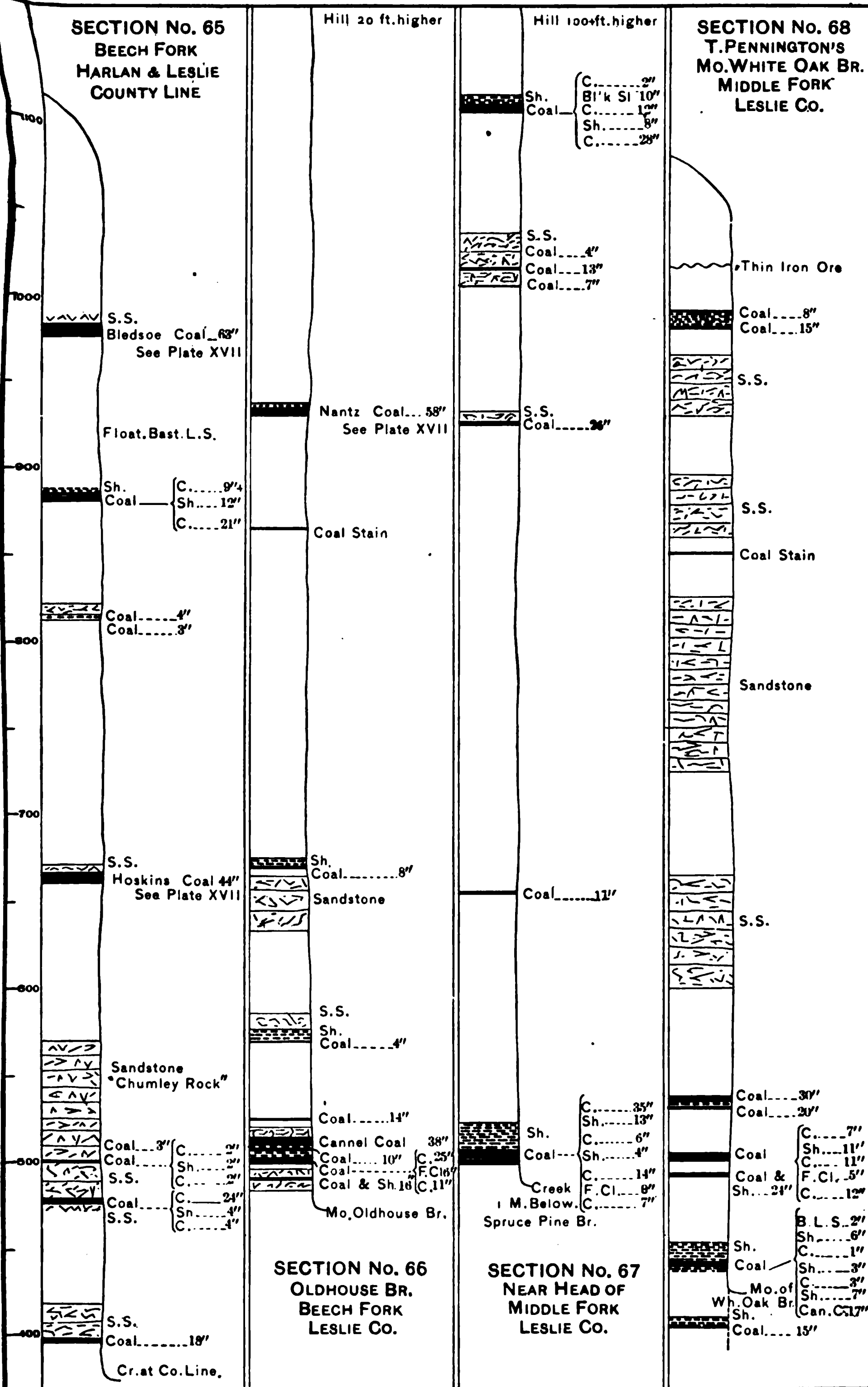


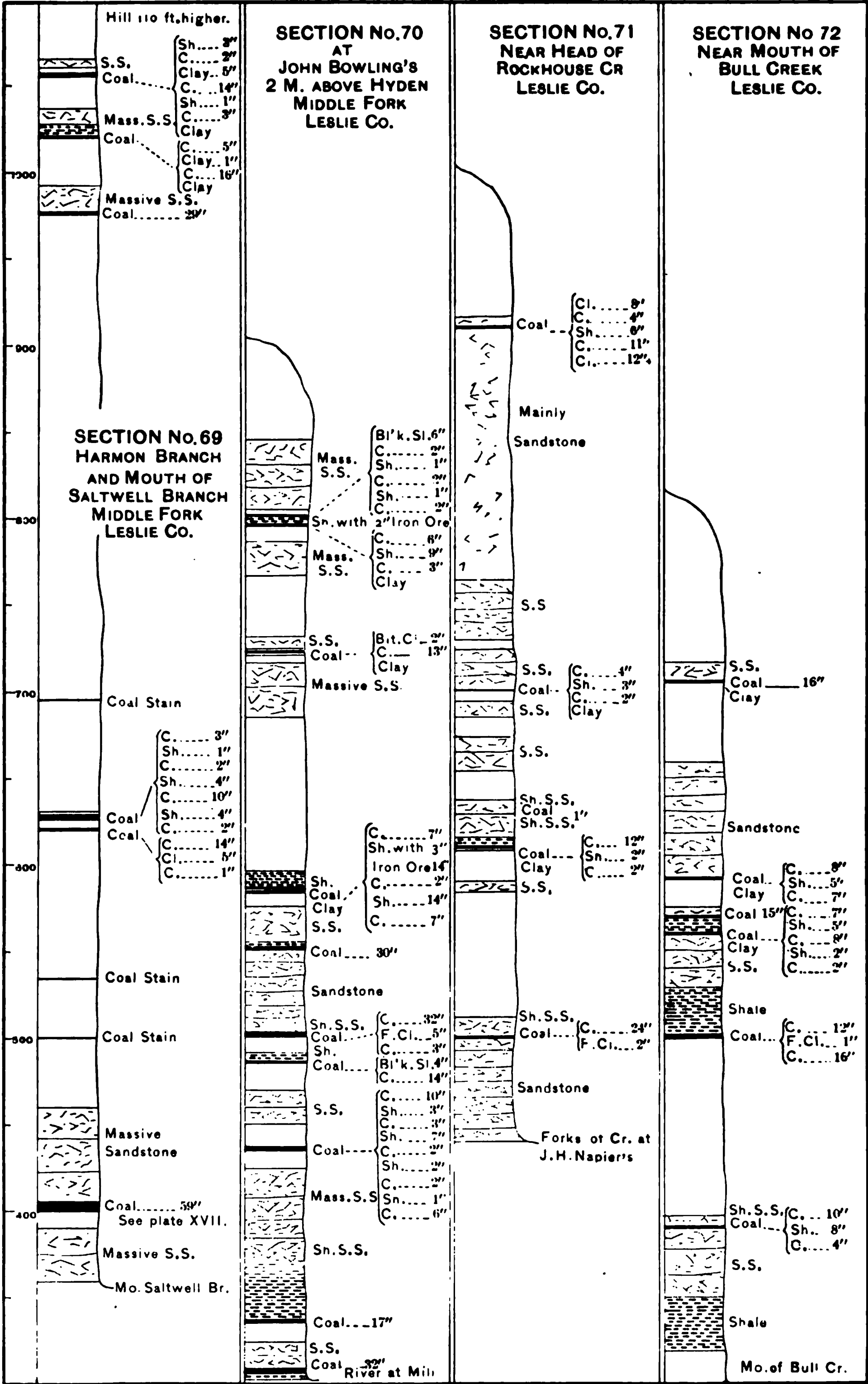
SECTION No. 65
BEECH FORK
HARLAN & LESLIE
COUNTY LINE

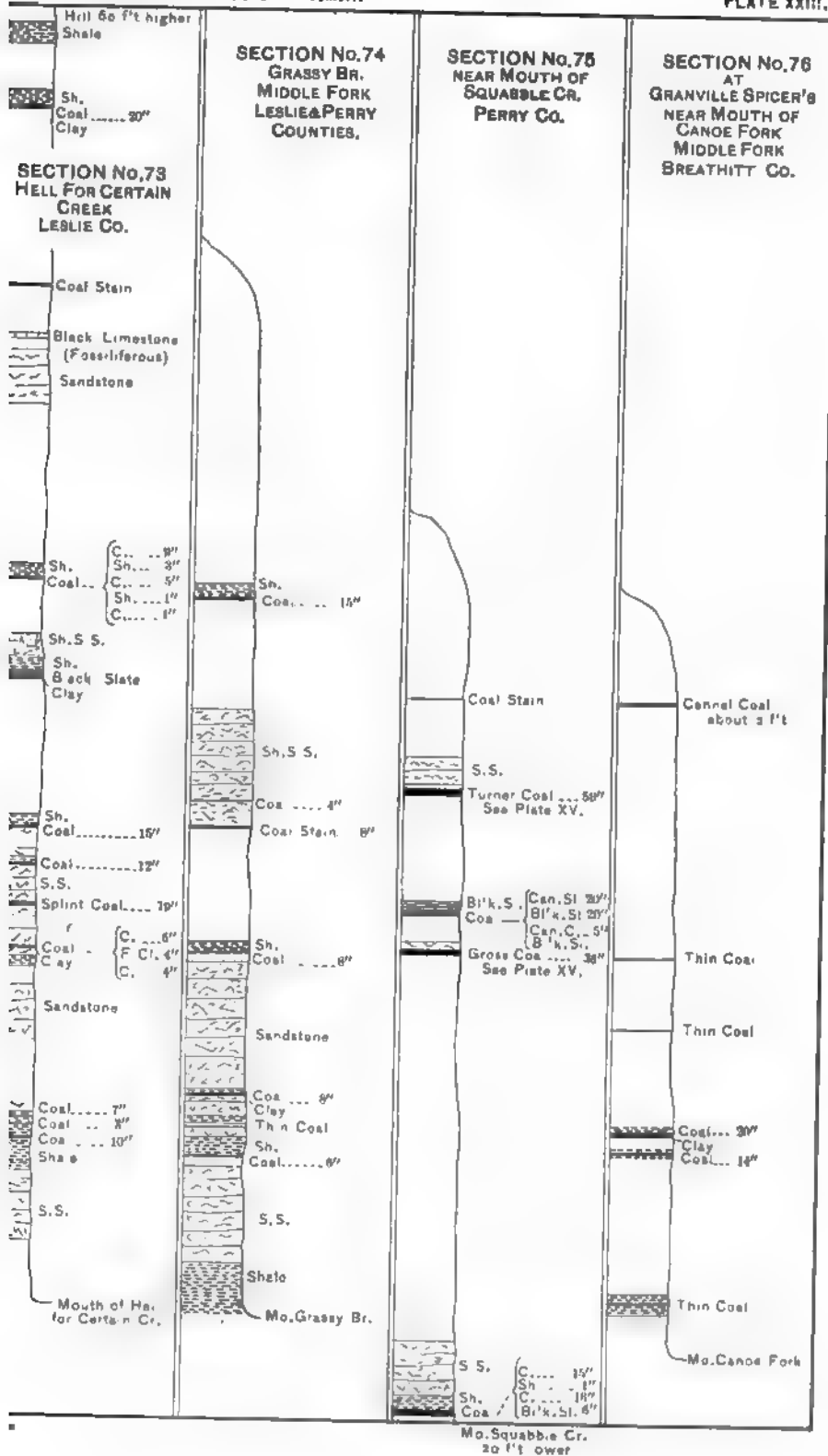
Hill 20 ft. higher

Hill 100+ft. higher

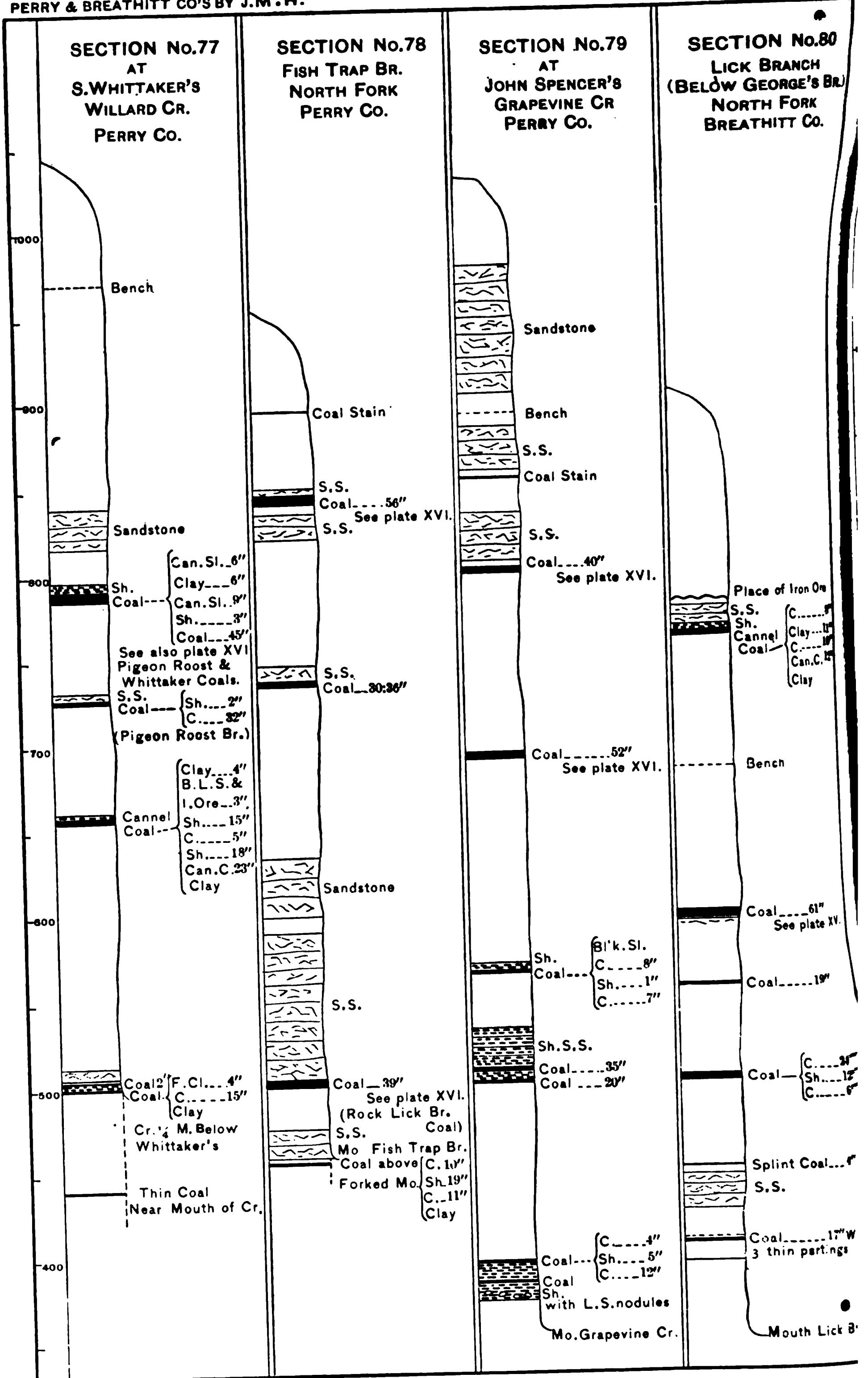
SECTION No. 68
T. PENNINGTON'S
MO. WHITE OAK BR.
MIDDLE FORK
LESLIE CO.



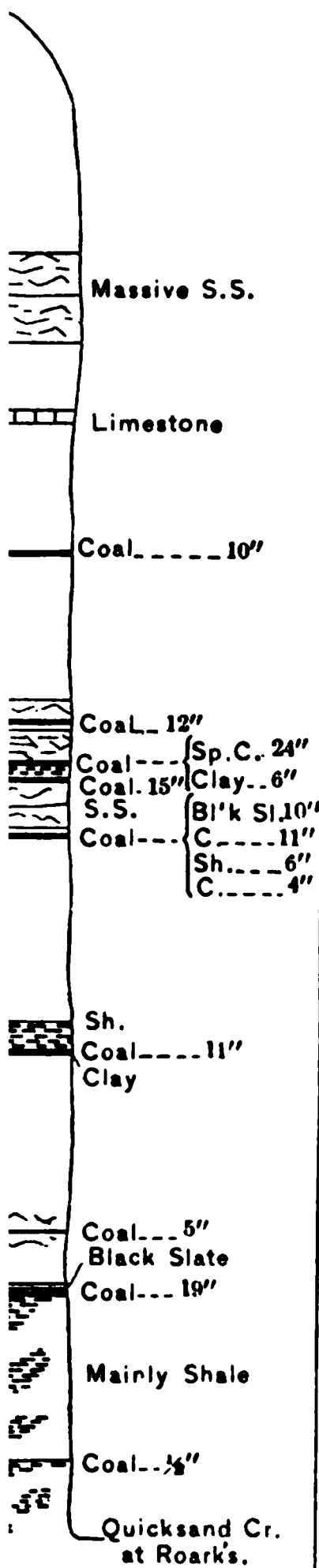




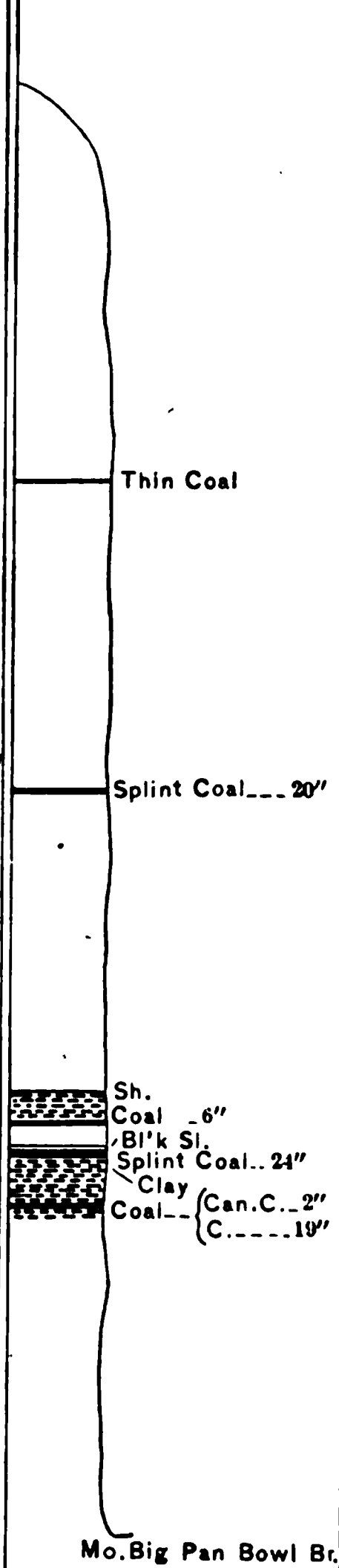
PERRY & BREATHITT CO'S BY J.M.H.



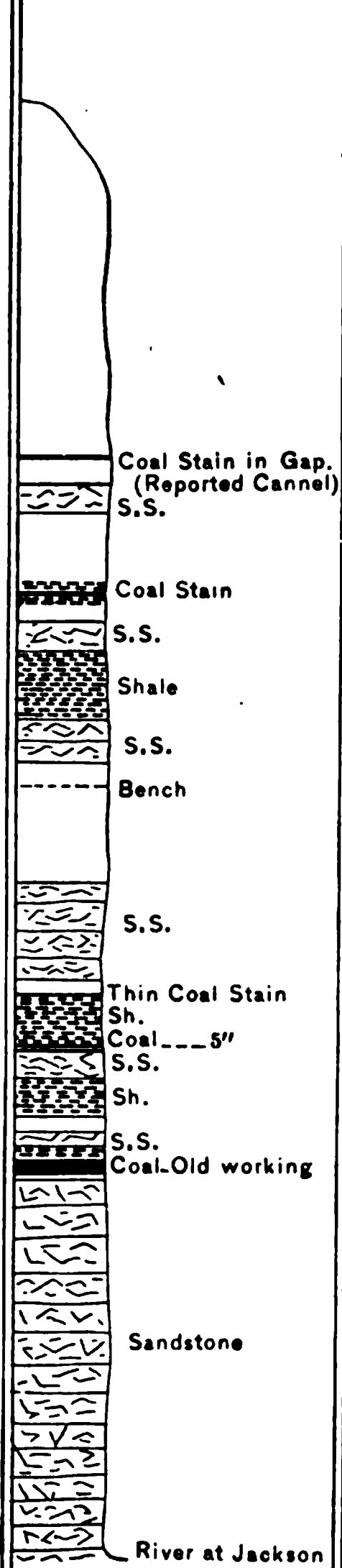
SECTION No.81
AT
JOHN ROARK'S
QUICKSAND CR.
BREATHITT CO.



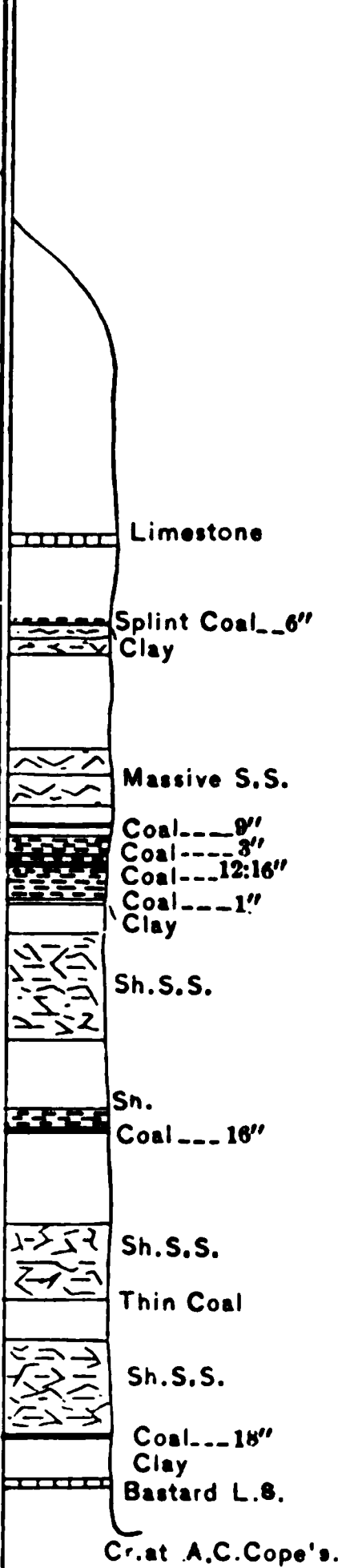
SECTION No.82
AT
JAMES ROBERT'S
BIG PAN BOWL BR.
BREATHITT CO.

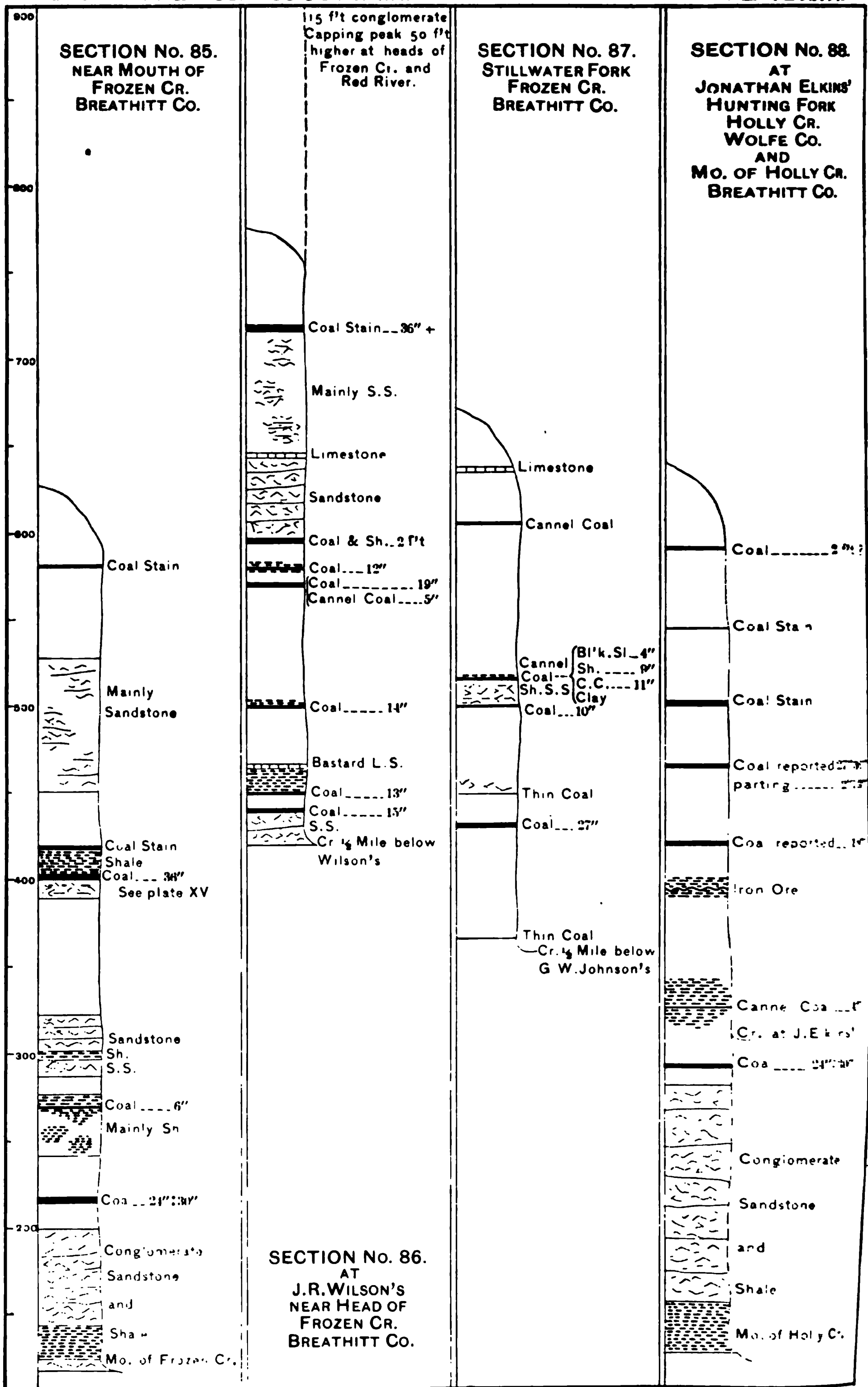


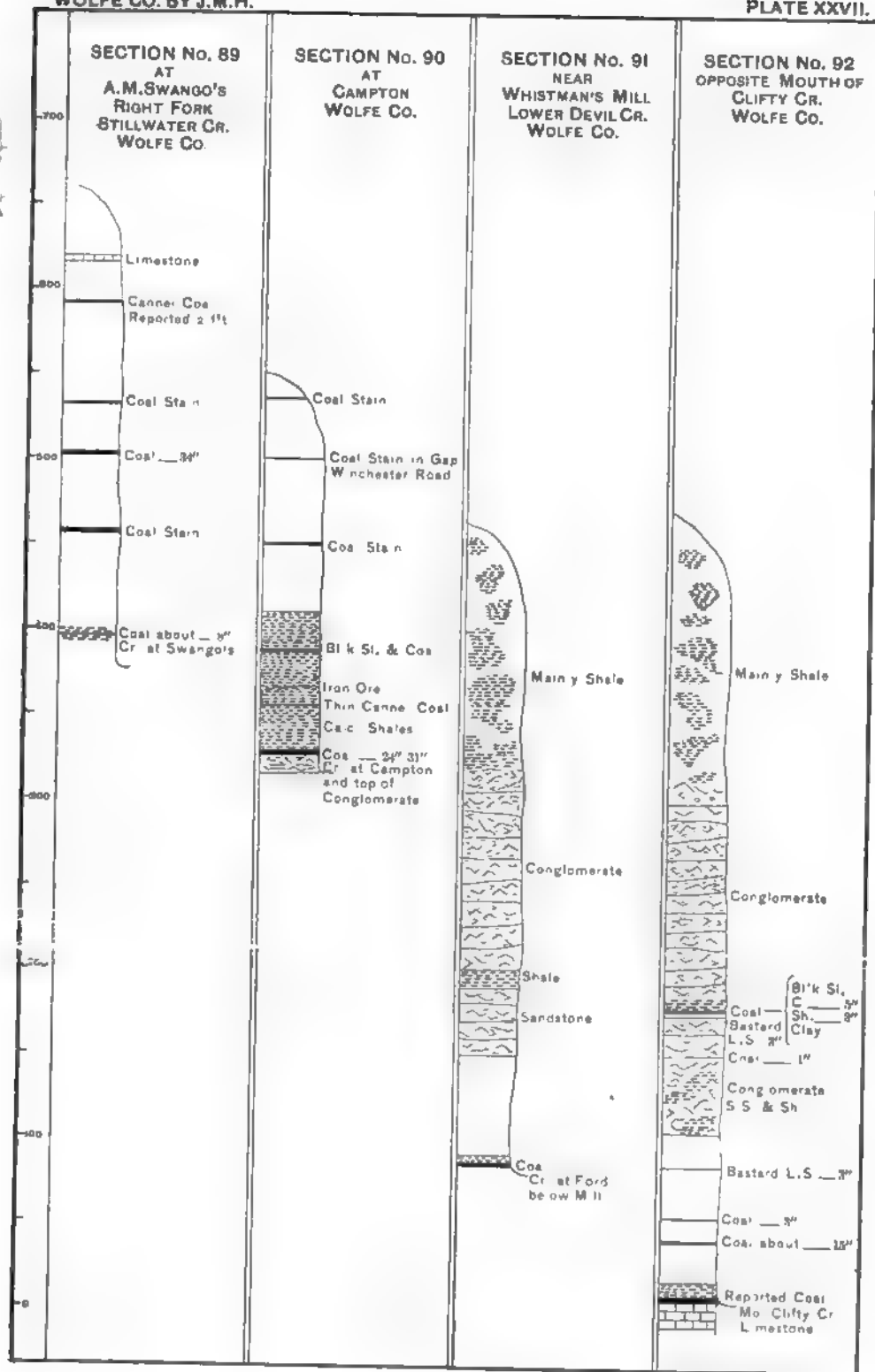
SECTION No.83
BETWEEN
JACKSON AND CANE CR.
BREATHITT CO.

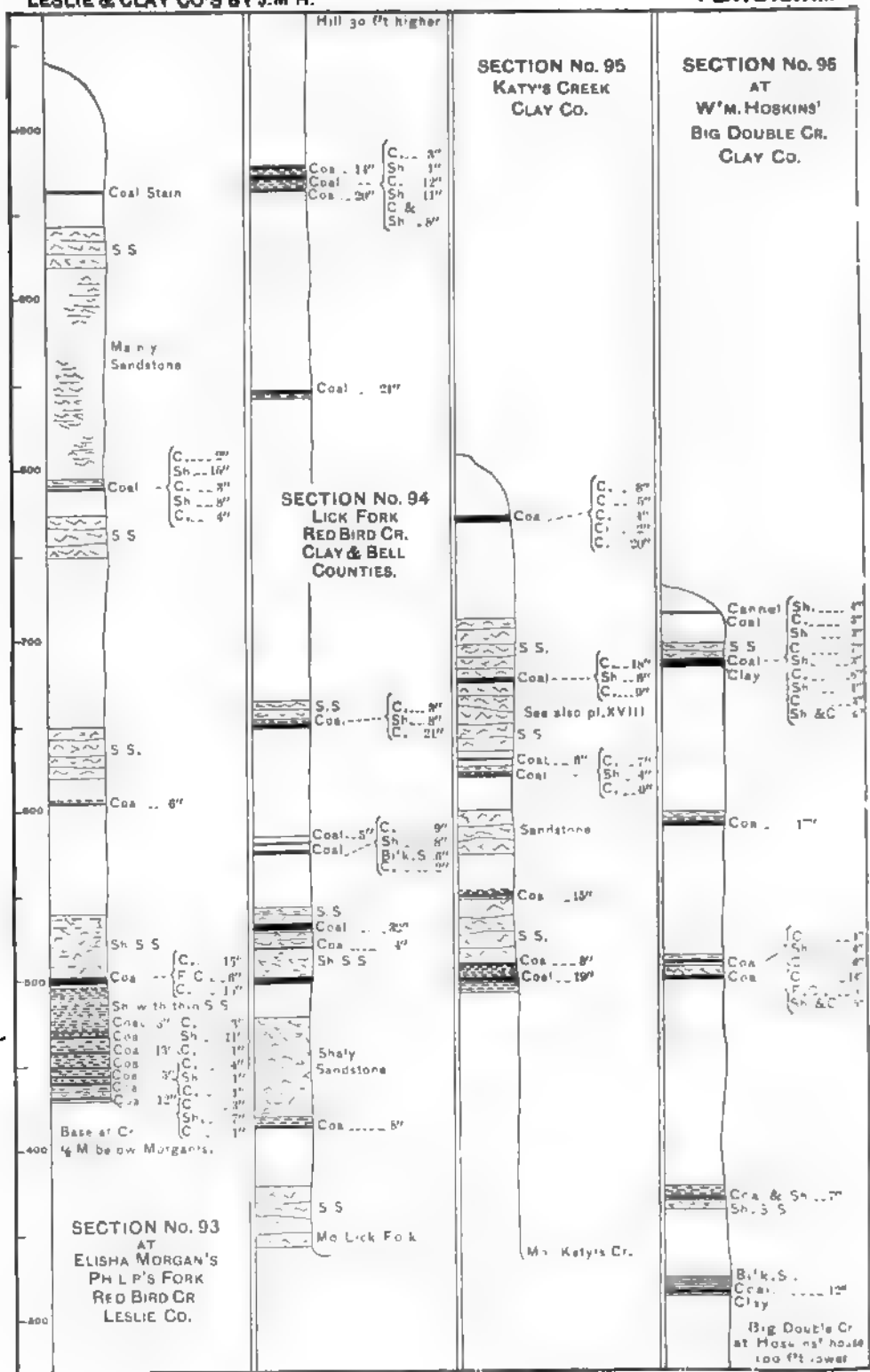


SECTION No.84
AT
A.C.COPE'S
COPE FORK
FROZEN CR.
BREATHITT CO.

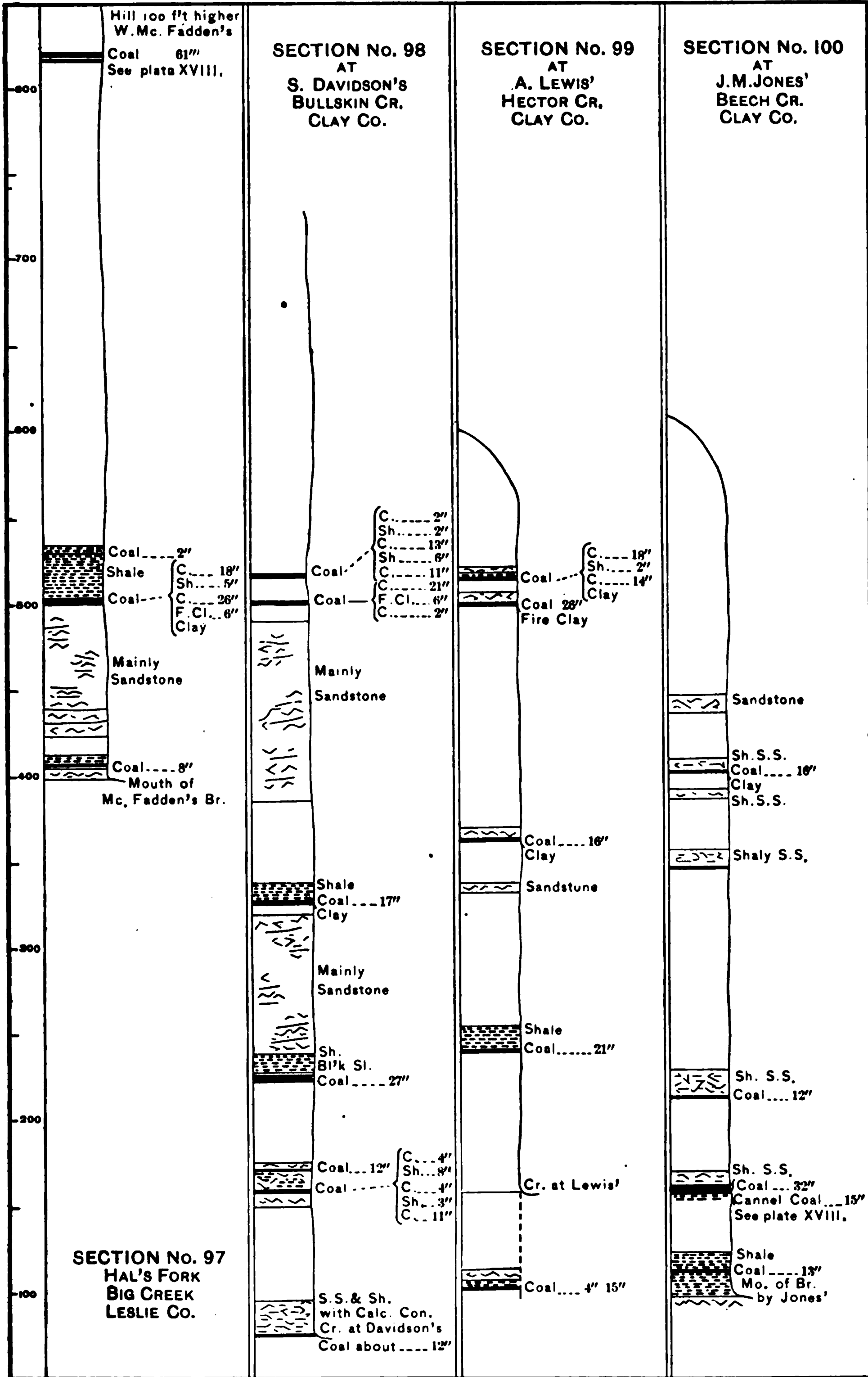


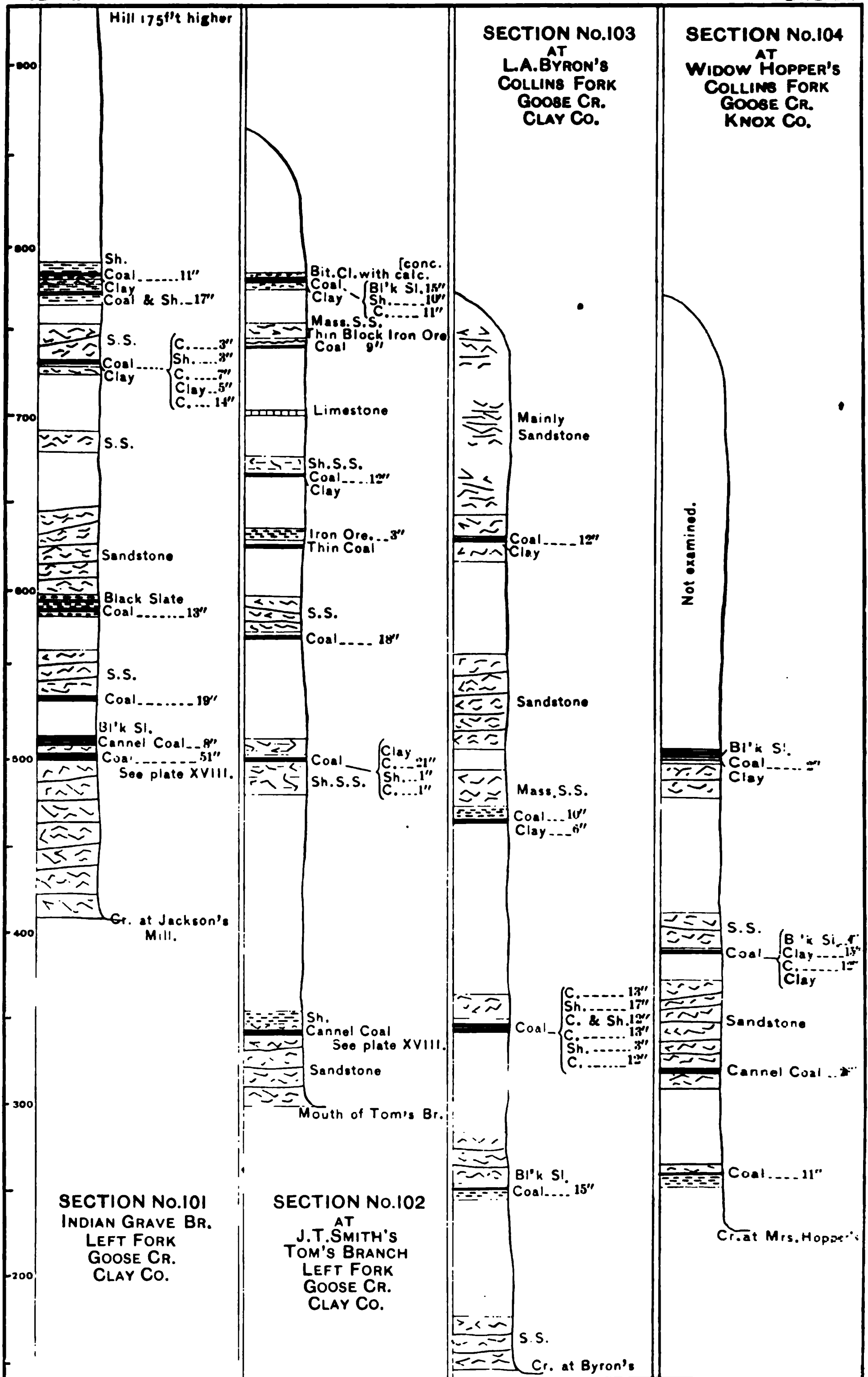






L. M. Feltz Eng. Co.





XVI.

LAWS RELATING TO MINING, ETC.

THE MINING LAW.

AN ACT to provide for and regulate the ventilation of coal mines in this State and for the better protection of miners, enacted by the General Assembly of 1891-93, and amended at the sessions of 1894 and 1898.

Be it enacted by the General Assembly of the Commonwealth of Kentucky: § 1. [First two sentences of Act of 1891-'93 repealed by section 3 of Act of 1898, and the following substituted therefor: That the Board of Trustees of the State College be and they are hereby authorized to establish a course of study in said College to be known and designated as the "Course of Mining Engineering," in which shall be taught all the branches of science relating thereto, and said Board of Trustees shall, after the expiration of the terms of service of the present Inspector and assistants respectively, select, as other professors are selected, a suitable and competent person for Dean of the same, with the necessary staff of assistants, and said Dean shall by reason of said selection be the Inspector of Mines with all the powers and privileges now conferred upon said Inspector by law. It shall be his duty to determine, by chemical analysis, or otherwise, the kind and quantity of the mineral products of the State of Kentucky as may be sent to him for inspection or analysis, and given written opinions thereon, but these latter duties shall not be allowed to interfere with his duties as Inspector, relative to the safe condition of the coal mines of the State. He shall take the required oath and give the same bond as now required by said officer. He and his assistants shall hold office on identically the same conditions with other professors in said College, and shall be subject to removal as they are.—From sec. 3, chap. 55, Acts of 1898.] Said Inspector

shall have a practical knowledge of chemistry, geology and mineralogy, and shall also possess a practical knowledge of the different systems of working and ventilating coal mines, and of the nature and properties of the noxious and poisonous gases of the mines, especially fire-damp, and he shall also have a practical knowledge of mining and engineering; and said Inspector shall, before he enters upon the discharge of his official duties, be sworn to discharge them faithfully and impartially, which oath shall be subscribed on his commission, and certified by the officer administering it, and his commission so indorsed shall be filed with the Secretary of State in his office; and said Inspector shall give bond in the penal sum of five thousand dollars, with surety, to be approved by the Governor, for the faithful discharge of his official duties.

§ 2. Said Inspector shall give his entire time and attention to the discharge of the duties of his office, and it shall be a part of his duty to visit and inspect, as often as may be necessary, all the coal mines in actual operation in Kentucky and to see that the provisions of this act are complied with by the owners, agents and superintendents of all the mines in this State.

§ 3. Said Inspector shall have power to visit and inspect any mine to which this act applies. He shall examine into the condition of such mine with respect to ventilation, drainage, timbering and general security; and if, upon inspection, he finds that such ventilation, drainage or timbering as the health or safety of the persons employed in the mine would require has not been provided, or should he find the mine insecure in any part, or should he find that sufficient means of ingress and egress have not been provided, said Inspector shall at once notify the agent, superintendent or owner of the mine as to the unsafe or unwholesome condition of such mine, and require him to put the mine in a safe and wholesome condition, and such mine shall forthwith be rendered safe and healthful. For a failure to comply with the directions of the Inspector to render such mine safe, and to provide such ventilation as is sought to be secured by this law, and to provide safe

and suitable means of ingress and egress within twenty days from the date of inspection, the agent or superintendent and owner shall be liable to a fine of fifty dollars per day for every day that such mine shall be suffered to remain in such unsafe or unhealthful condition after the expiration of the twenty days above provided in which the required improvements should be made, which fine may be collected by indictment by the grand jury of the county in which such mine is situate; but in cases in which the Inspector is satisfied, from personal investigation, that, even if due diligence is observed, the required improvements can not be completed within the thirty [20] days above provided, he shall have authority to extend the time for not more than twenty days longer; but when the time is thus extended, the agent, superintendent or owner who is delinquent after the expiration of the additional time, shall be subject to indictment and fine as above provided; and as a cumulative remedy in case of failure of any owner, agent or superintendent to conform to the provisions of this law, after notice from the Inspector, within the time provided by this section, any circuit court, or the judge in vacation, may, on application of the Inspector, by civil action, in the name of the State, enjoin or restrain, by writ of injunction, the said owner or agent or superintendent from working or operating such mine with more than five persons until it is made to conform with the provisions of this law. But before such writ of injunction shall issue, the owner, agent or superintendent shall have at least three days' notice of such contemplated action, and shall have the right to appear before such court, or the judge in vacation to whom the application is made, who shall hear the same on affidavits and such other testimony as may be offered in support, as well as in opposition thereto. It shall be the duty of the Commonwealth's Attorney of the district, and of the county attorney of the county in which the mine lies, to prepare and prosecute proceedings upon said application. [This section is in accordance with amendment approved March 3, 1894.]

§ 4. The Inspector of Mines shall be provided with all neces-

sary stationery, to be supplied by or through the State Librarian as other offices are supplied; and he shall keep a record of all the inspections made by him and shall furnish a certified copy of his report of the inspection of any mine inspected by him to the Commonwealth's Attorney of the district in which the mine is situated, on application therefor, which copy shall be admissible in evidence in any court in this Commonwealth, and shall be *prima facie* evidence of the truth of recitals therein contained. [As amended by Act of 1898.]

§ 5. Such Inspector while in office shall not act as agent, or as a manager or mining engineer for, or be interested in operating any mine, and he shall annually, on or before the tenth day of February, make report to the Governor of his proceedings for and during the calendar year ending on thirty-first day of December, and of the condition and operation of the coal mines in this State, enumerating all accidents which shall have occurred in or about the same, and giving such other information as he may deem useful, and making such suggestions as he may deem important as to further legislation on the subject of mining. The Inspector shall also report the number of persons employed in and about the mines, and the amount of coal mined; and, for the purpose of enabling him to make such report as is required by this section, the owner, lessee, agent, or superintendent of every mine to which this law applies is hereby required to give, each month, accurate information, on blanks to be furnished by the Inspector, as to all accidents occurring in or about the mines, the number of persons employed, and the amount of coal mined during the preceding month; and the owner, lessee or superintendent refusing or failing to furnish the Inspector such information for sixty days after application therefor has been received, shall be liable to a fine of fifty dollars, to be recovered in the county in which the mine concerning which such information is refused is situated. The Inspector is authorized to extend his observations, so as to be prepared to report upon the mining possibilities and mineral resources of the counties to which he is called in the prosecution of

his duties as Inspector. One thousand copies of the Inspector's annual report shall be printed for general distribution.

§ 6. The Inspector shall receive an annual salary of eighteen hundred dollars, payable monthly, and shall likewise be allowed and paid his necessary traveling expenses when absent from his office on business connected with his department; and he shall keep on file in his office maps and plans of all coal mines in operation in this State, which maps, plans, and all the books, records and apparatus of his office, he shall carefully keep and turn over the same, with all official correspondence pertaining to his office, to his successor; and upon application of the owner, agent, lessee or superintendent therefor, he shall make out a duplicate of any map on file in his office of any mine owned or operated by the owner, agent, lessee or superintendent making such application, for the making of which duplicate a fee of five dollars must be paid, and which fee shall, within thirty days after its reception, be paid into the State Treasury by the Inspector receiving it.

§ 7. There shall be provided for said Inspector all instruments and chemical tests necessary for the discharge of his duties under this law, which shall be paid for on the order of the Inspector, and which shall belong to the State.

§ 8. The owner, agent, lessee or superintendent of every coal mine in this State, to which this law applies, shall annually, within sixty (60) days after the first day of January, make or cause to be made, an accurate map or plan of the workings of such mine, on a scale of not more than one hundred feet to the inch, showing the area mined and the form of the excavations up to the said first day of January, together with the location and connection with such excavations of the lines of all adjoining lands, and the name or names of each owner or owners so far as known, marked on each tract; a true copy of which map the said owner, agent, lessee or superintendent shall deposit with the Inspector of Mines within seventy days after said first day of January, and another copy of which shall be kept at the office of such mine. But, after the making of and filing with said Inspector of the first map of the

mine, as required herein, the owner, agent, lessee or superintendent, shall only be required to annually make and file with said Inspector, within the times herein specified, such additional map and statement as may be necessary to truly show the progress of the workings and the amount of excavation of said mine from the date of the preceding map or survey up to the first day of January as provided herein. The Inspector shall annually, on or before the first day of January, give warning notice that said map is required; and upon the refusal or failure of the agent, owner, lessee or superintendent receiving such notice, to make, or cause to be made, such map within the sixty (60) days, and deposit the same with the Inspector within the seventy (70) days, specified herein, said owner, agent, lessee or superintendent shall be liable to a fine of five dollars (\$5) a day for each day elapsing until said map is made, said fine to be recovered in the county in which the mine to be mapped is situated. The correctness of each map provided for by this section shall be certified to by the person making such map; and the Inspector may reject any map as incomplete, the accuracy of which is not so attested.

§ 9. It shall not be lawful for the owner, agent or superintendent of any coal mine, worked by a shaft, slope or drift, wherein fifteen thousand square yards have been excavated, to employ more than ten persons to work therein, or to permit more than ten persons to work in such mine, unless there are to every seam of coal worked in each mine at least two separate outlets, separated by natural strata of not less than one hundred feet in breadth, by which shafts or outlets distinct means of ingress and egress are always available to the persons employed in such mines; but it shall not be necessary for the two outlets to belong to the same mine; and every shaft opened after the passage of this act shall have two such separate outlets after fifteen thousand square yards shall have been excavated; and to all other mines, whether slopes or drifts, two such openings or outlets shall be provided within twelve months after the passage of this law, provided fifteen thousand square yards have been excavated at or before the

passage of this law, or if not, then within twelve months after that extent has been excavated. In case any coal mine has but one shaft, slope or drift for the ingress or egress of the men working therein, and the owner thereof does not own suitable ground for another opening, such owner may select appropriate associate adjacent surface ground for that purpose, and have the same condemned, and appropriate the same by proceedings in the county court of the county where the mine is situated, similar to proceedings now allowed by law for securing a private passway.

§ 10. The owner, agent or lessee of every coal mine, whether slope, shaft or drift to which this act applies, shall provide and maintain for every such mine an amount of ventilation of not less than one hundred cubic feet of air per minute per person employed in such mine, which shall be circulated and distributed throughout the mine in such a manner as to dilute, render harmless, and expel the poisonous and noxious gases from each and every working place in the mine, and no working place shall be driven more than sixty feet in advance of a break-through or air-way; and all break-throughs or air-ways, except those last made near the working face of the mine, shall be closed up and made air-tight by brattice, trap doors, or otherwise, so that the currents of air in circulation in the mine may sweep to the interior of the excavations where the persons employed in the mines are at work; and all mines governed by this statute shall be provided with artificial means for producing ventilation, such as suction or forcing fans, exhaust steam, furnaces, or other contrivances of such like capacity and power as to produce and maintain an abundant supply of air. All mines generating fire-damp shall be kept free from standing gas, and every working place shall be carefully examined every morning with a safety lamp, by a competent person or persons, before any of the workmen are allowed to enter the mine. And at every mine operated by a shaft there shall be provided an approved safety-catch, and a sufficient cover overhead, on all cages used for lowering and hoisting persons, and at the top of every shaft a safety-gate shall be provided, and an adequate

brake shall be attached to every drum or machine used in lowering or raising persons in all shafts and slopes.

§ 11. Any person employed in any mine governed by this statute who intentionally or willfully neglects or refuses to securely prop the roof of any working place under his control, or neglects or refuses to obey any order given by the superintendent of the mine in relation to the security of that part of the bank where he is at work and whoever knowingly and wilfully does any act endangering the lives or health of the persons employed in a mine or the security of the mine or machinery, shall be liable to a fine of not less than ten dollars nor more than fifty dollars, to be recovered in the county in which the mine is situate.

§ 12. Coal mines in which not more than five persons are employed at one time shall be exempt from the provisions of this law.

§ 13. On account of the emergency hereby declared to exist, in that it is necessary for the employes in mines to receive the protection of the provisions of this law in timely season, this law shall be in force from its approval by the Governor.

Approved February 15, 1893.

CURATOR OF GEOLOGICAL DEPARTMENT.

EXTRACT from Resolution 61 of General Assembly of 1891-92-93, as amended in Chapter 78 of Acts of General Assembly of 1894.

1. That the Inspector of Mines, in addition to his duties as such Inspector, shall be Curator of the Cabinet and other property of the Geological Survey or Department, and all the records documents, collections, instruments, apparatus, books, maps and other property of the Survey are hereby confided to his care and keeping; and, as such Curator, he is hereby required to attend to all correspondence and respond to all requests concerning the mineral resources of the State that come to him in his said capacity; to attend to the distribution of all published maps and reports

in his hands intended for distribution, and to perform all the duties usually devolving upon such a Curator, so far as is applicable in this case; and he shall whenever the General Assembly shall direct and provide therefor, cause to be printed under his supervision, any or all of the unpublished reports of the Geological Survey that may be in his custody. He shall be allowed and paid fifty dollars per month as compensation for his services as such Curator, and shall give bond for the faithful performance of his duties as such Curator, with surety to be approved by the Governor.

ASSISTANT INSPECTOR.

AN ACT to increase the efficiency of the Inspector of Mines, and more fully provide for the protection of the lives and health of persons employed in the coal mines of this State, enacted by the General Assembly of 1891-92-93. Approved December 3, 1892, and June 9, 1893.

Be it enacted by the General Assembly of the Commonwealth of Kentucky: § 1. Every mine subject to the provisions of the act providing for the inspection of the coal mines, shall be inspected not less than three times each year, the inspection to be, as nearly as possible, not more than four months apart, and as many more times as the facilities of the office will permit.

2. [First sentence of Act of 1893 repealed and an Assistant Inspector, to render effective section one above, provided for by section 3 of Act of 1898. See section 1 relating to Inspector of Mines, Acts of 1891-3, 1894 and 1898, preceding.] Said Assistant Inspector shall have a practical knowledge of the different systems of working and ventilating coal mines, and of the nature and properties of the noxious and poisonous gases of mines, especially of fire-damp, and he shall also have a practical knowledge of mining. Said Assistant Inspector shall before entering upon the discharge of his official duties be sworn to discharge them faithfully and impartially, which oath shall be subscribed on his commission and certified by the officer administering it, and his

commission so indorsed, shall be filed with the Secretary of State in his office, and said Assistant Inspector shall give bond in the penal sum of two thousand dollars, with surety, to be approved by the Governor, for the faithful discharge of his official duties.

3. Said Assistant Inspector shall give his entire time and attention to the duties of his office, which shall consist of aiding, under the direction of the Inspector of Mines, in carrying out the provisions of this and all other acts relating to the inspection of coal mines.

4. Such Assistant Inspector, while in office, shall not act as agent or as a manager or mining engineer for, or be interested in operating any coal mine in this State. He shall receive an annual salary of \$1,200 (twelve hundred dollars), payable monthly, and shall likewise be allowed and paid his necessary traveling expenses when absent from his office on business connected with his department. He shall have his office with the Inspector of Mines, and shall keep a record of all inspections made by him, and make a monthly report of the same to the Inspector of Mines for said Inspector's use when preparing his annual report. [As amended by Act of 1898.]

5. [As amended and approved June 9, 1893.] For the reason that the number of mines in this State, subject to the law requiring inspection is now so great that it is impossible for one person charged with the duties of Inspector of Mines to give all of them the immediate, detailed and frequent attention they require, and, in addition, discharge the other duties of his office, an emergency is hereby declared to exist, and this act shall be in force from its approval by the Governor; but the term of said Assistant Inspector of Mines provided for herein, and his salary, shall begin only with the date of his appointment.

(Act went into effect June 9, 1893.)

TO PROVIDE FOR A CHECK-WEIGHMAN.

CHAPTER 1251 of Acts of General Assembly of 1885-86.

Be it enacted by the General Assembly of the Commonwealth of Kentucky: § 1. That when a majority of the miners engaged in digging or mining coal at any coal mine in this State, at which as many as twenty men are employed, request the owner or owners, or operator or operators, of any of said mines to allow said miners to employ, at their own expense, a person to inspect the scales at said mine, and see that all the coal digged and mined by said miners is properly weighed and accounted for, and do and perform such other duties as will insure that said coal is properly weighed and correctly accounted for, said owner or owners, or operator or operators, shall permit such person to be employed by said miners making the request: Provided, The person so employed has the reputation of being an honest, trustworthy, discreet and upright man. The appointment, under the provisions of this act of each Inspector and assistant weigher, shall be approved by the judge of the county court of the county wherein the same is made.

§ 2. The person appointed and employed by miners to perform the duties set forth in the first section of this act shall, at all times, have free access to the scales at the mines, and the said person so employed by the miners shall not be hindered or prevented from a proper performance of his duties by the person who weighs coal for the operator or operators of any mines, nor any of the agents or employes of said operator or operators. Said person employed by the miners shall in no way prevent the weighman or other employes of said operator or operators from performing their duties in a proper manner.

§ 3. Any person violating any of the provisions of this act shall be fined not less than ten nor more than fifty dollars, and each day on which any of the provisions of this act is violated shall constitute a separate offense.

§ 4. This act shall take effect and be in force from and after its passage.

Approved May 18, 1886.

[By oversight this law was omitted from the Kentucky Statutes compiled by Barbour & Carroll, 1894.]

ROADS FROM MINES.

SECTION 815, Kentucky Statutes, 1894.

§ 815. Any person engaged in operating a mine or stone quarry within three miles of any navigable stream or railroad may, for the purpose of transporting material to and from such stream or railroad, and such mine or quarry, construct and operate a line of railroad from such mine or quarry, to the most convenient and accessible point on such stream or road, and may, under the general laws, condemn such land as may be necessary, not exceeding fifty feet in width for each track necessarily constructed, and not exceeding two acres of land at such railroad or stream for the purpose of necessary buildings. The owner or operator of such roads shall be, so far as they are applicable, governed and controlled by the laws relating to other railroads, and shall have the same rights and privileges granted to corporations owning and operating lines of railroad.

WAGES—PAYMENT IN MONEY—STATUTORY REQUIREMENT—CONSTRUCTION.

KENTUCKY STATUTES, Chapter 36, Section 1350—Wage-earners—Penalty for Not Paying in Money.

That any corporation or person or persons having the ownership or control of any factory, mine or workshop in this Commonwealth, who shall violate the provisions of sec. 244 of the Constitution, reading as follows: "All wage-earners in this State em-

ployed in factories, mines, workshops, or by corporations shall be paid for their labor in lawful money," shall be guilty of a misdemeanor, and, on trial and conviction, had in any court of competent jurisdiction, shall be fined not exceeding five hundred dollars for each violation thereof.

KENTUCKY STATUTES, Chapter 36, Section 1386—Notes of Incorporated Banks Only to be Circulated.

It shall not be lawful to make, offer to pay, or to pass or offer to pass any note, bill, order or other thing passing by delivery, as a circulating medium, in lieu of or as the representative of money, unless it be the note or bill, of not less than five dollars, of some banking institution legally incorporated in the United States, or currency of the United States. If a note, bill, order or other such thing, be of the denomination of less than five dollars, it shall be presumed to have been made, paid or passed, or offered in violation of this section unless the contrary be shown.

CONSTRUCTION.

Case in Point.—The Avent Beattyville Coal Co., Lee county, was convicted of not paying its wage-earners in lawful money, and appealed. Reversed.

In Brief.—A mining company paid its employes once each month in lawful money for the past month's labor, and at any time during the month, upon their application, issued checks to them, payable in merchandise at the company's store. The amount of checks so issued to each man was deducted from his wages on every pay-day and he was paid the balance in cash, but no money was paid for outstanding checks. Held—That such arrangement was not in violation of Constitution, section 244, and Stats. of Ky., section 1350, providing that wage-earners shall be paid for their labor in lawful money. (Opinion delivered by Judge Hazelrigg, December 1, 1894. Published in full in Report for 1894.)

CHAPTER 15, SESSION 1898.

AN ACT concerning employes and servants in mining work or industry in this Commonwealth.

Be it enacted by the General Assembly of the Commonwealth of Kentucky: § 1. That all persons, associations, companies and corporations employing the services of ten or more persons in any mining work or mining industry in this Commonwealth, shall on or before the sixteenth day of each month pay for the month previous such servant or employe on his or their order in lawful money of the United States the full amount of wages due such servant or employes rendering such services. But if such person, corporation or company, after using due diligence, is unable to make said payment as above required he or it shall within fifteen days thereafter make out a payroll and statement of amount due each employe and also a due bill for said sum bearing interest from said sixteenth day of the month, and deliver same to each of said employes.

§ 2. It shall be unlawful for any person or persons, association, company, or corporation employing others, as described in section one, either directly or indirectly, to coerce or require any such servant or employe to deal with or purchase any article of food, clothing or merchandise of any kind whatever, from any person, association, corporation or company, or at any place or store whatever. And it shall be unlawful for any such employers as described in the first section to exclude from work or to punish or blacklist any of said employes for failure to deal with any other or to purchase any article of food, clothing or merchandise whatever from any other or at any place or store whatever.

§ 3. Any person or persons, company or corporation described in the first section that shall violate any of the provisions of this act shall be guilty of a misdemeanor and on conviction shall be

fined not less than fifty dollars nor more than one hundred dollars for each offense, and the doing or failure to do any act or thing required by this act shall constitute a separate offense.

Received by the Governor, March 2, 1898.

Became a law at the expiration of ten days without the Governor's approval.

CHILD LABOR LAW.

CHAPTER 16, Acts of General Assembly of 1902.

AN ACT to make it unlawful to employ a child less than fourteen years of age in work-shops, mines, mills or factories in this Commonwealth and fixing a penalty.

Be it enacted by the General Assembly of the Commonwealth of Kentucky: § 1. That it shall be unlawful for a proprietor, foreman, owner or other person to employ any child less than fourteen years of age in any workshop, factory or mine, in this State; that unless said proprietor, foreman or owner shall know the age of the child, it shall be his or their duty to require the parent or guardian to furnish a sworn statement of its age, and any swearing falsely to such by the parent or guardian shall be perjury and punishable as such. Provided, That if the parent or guardian and the county judge of any county may consent in writing for such employment, then in that event such employment may be made, subject to the approval of the county attorney of said county, in the event of any complaint, and if he thinks, after investigation of such complaint, that it is against the best interests or moral welfare of such infant child, he may so notify said employe, and then this act applies as if no consent was given.

§ 2. That any proprietor, foreman or owner employing a child less than fourteen years of age in conflict with the provisions of this Act, except where such proprietor, foreman or owner has been furnished with a sworn statement of guardian or parent that the child is more than fourteen years of age, shall be guilty of a mis-

demeanor, and upon conviction, shall be fined not less than twenty-five dollars and not more than two hundred and fifty dollars.

§ 3. That the grand jury shall have inquisitional powers to investigate violations of this Act, and that judges of the circuit courts of the State shall specially charge the grand jury at the beginning of each term of the court to investigate violations of this Act.

§ 4. That this Act shall take effect ninety days after the adjournment of this General Assembly.

GERALD T. FINN,

Speaker of the House of Representatives.

NEWTON W. UTLEY,

President *pro tem* of the Senate.

Approved March 12, 1902: J. C. W. BECKHAM,

By the Governor:

Governor

C. B. HILL, Secretary of State. ✓

